# Plastics

DEALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC

TECHNOLOGY DEPT
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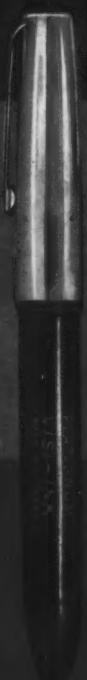


Take the pens, for instance: they're good to handle — and even a schoolboy would find them hard to break. Cellulose acetate is tough.

Take the table lighter: a luxury article. Cellulose acetate — unlike so many other plastics — is unaffected by petrol; and what plastic has a finish more luxurious?

Take the miniature oiling pen: cellulose acetate's clean transparency and imperviousness to oil puts a good idea into its most practical form.

Take the globe and its stand (all cellulose acetate): put your finger on any region, and it's more than likely that they're using products made with Courtaulds' cellulose acetate moulding powders.

**Courtaulds**

**cellulose acetate moulding powders**

**Courtaulds' Technical Service**
welcome your enquiries about any aspect of plastics.
**Plastics Division: Little Heath, Coventry**
Telephone: Coventry 88031.
16 St. Martin's-le-Grand, London, E.C.1.
Telephone: Monarch 8811.

extremely tough
and durable
unlimited colours
not brittle
no fire risks
clean contours

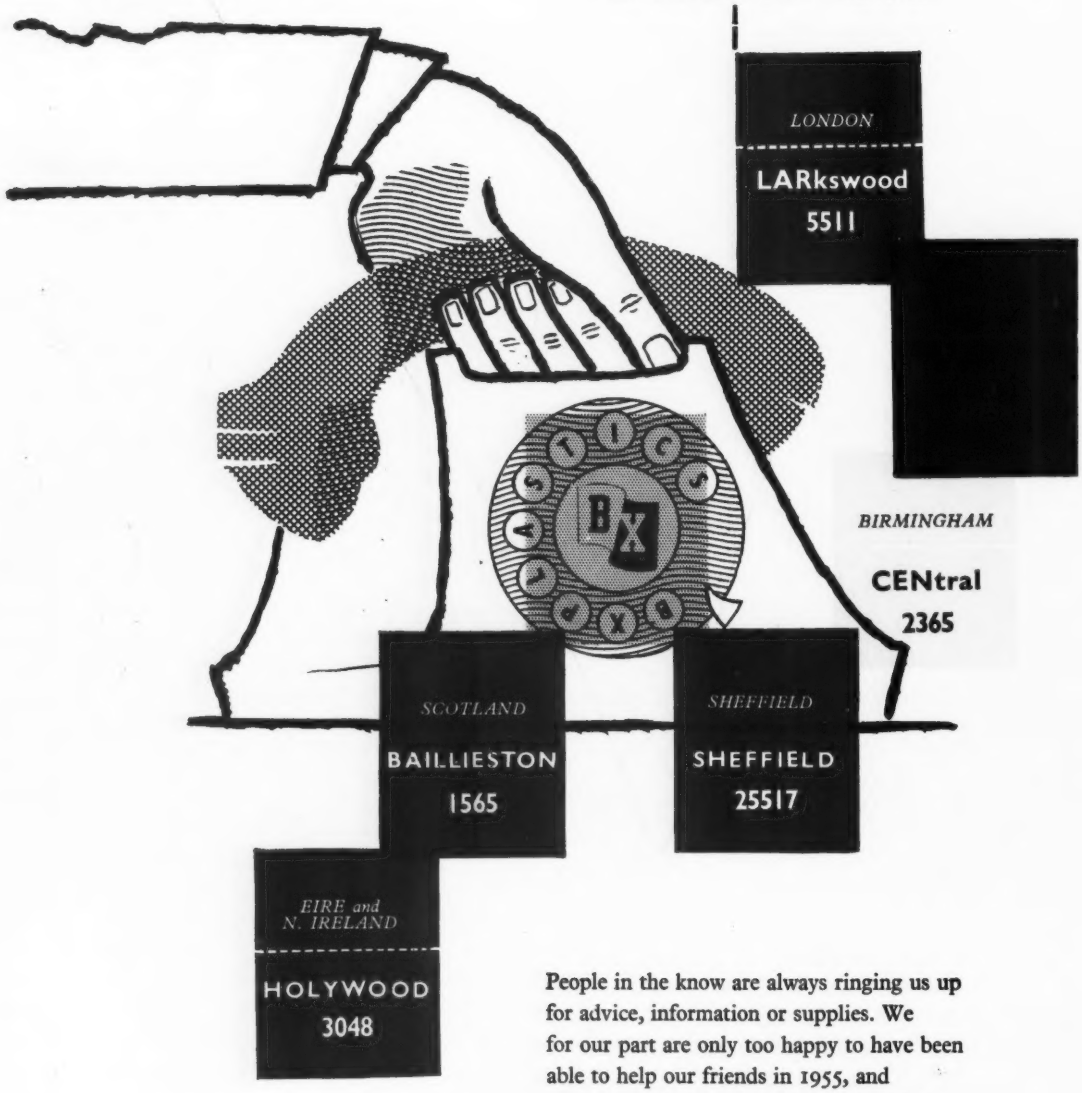
R v.20 Ja-De '56



**for anything**

**in thermoplastics . . .**

**PHONE BX**




People in the know are always ringing us up for advice, information or supplies. We for our part are only too happy to have been able to help our friends in 1955, and look forward to hearing from them again—and from those who haven't got around to dialling us yet—in 1956.

BX PLASTICS LIMITED · HEAD SALES OFFICE · HIGHAM STATION AVENUE · LONDON E.4

T.A.8779

Tech

# Advanced Plastics Processing

## Reifenhäuser Extruder

S 90 RGV

Sole British Agent : ED. BRAND LTD.,
9, St. Cross Street, Hatton Garden, London, E.C.1
Telephone : Chancery 4091 (3 lines)
Telegrams : Wyrellous, London

# All New HPM

## THE WORLD'S *MOST COMPLETE LINE* OF PLASTICS INJECTION MACHINES!

| STANDARD INJECTION MACHINES | | | | |
|---|---|---|---|---|
| MODEL NUMBER | 150-H-6 | 300-H-12 | 400-H-20 | 800-H-48 |
| Capacity (oz.–Single Feed) | 6 | 12 | 20 | 48 |
| Capacity (oz.–Double Feed) | 8 | 16 | 28 | 64 |
| Material Injected (cu. in. per min.) | 440 | 1035 | 1330 | 2895 |
| Plasticizing Capacity (lbs. per hour) | 60 | 100 | 135 | 350 |
| Mould Clamp Capacity (tons) | 150 | 300 | 400 | 800 |
| Mould Space (hor. × vert.): | | | | |
| (*a*) Full Platen Vert. | 10½″ × 25″ | 16½″ × 33″ | 20½″ × 42″ | 36″ × 54″ |
| (*b*) Full Platen Hor. | 20½″ × 15″ | 30″ × 20″ | 36″ × 26½″ | 54″ × 36″ |
| Daylight Opening without Ram Spacer | 20″ | 30″ | 40″ | 55″ |
| Daylight Opening with Ram Spacer | 16″ | 26″ | 34″ | 47″ |
| Mould Thickness without Ram Spacer | 10″ | 10″ | 15″ | 20″ |
| Mould Thickness with Ram Spacer | 6″ | 6″ | 9″ | 12″ |
| Clamp Travel (max.) | 10″ | 20″ | 25″ | 35″ |
| Motor Horse-power | 20 | 40 | 50 | 100 |
| Shipping Weight (pounds) | 14500 | 22000 | 39000 | 75000 |

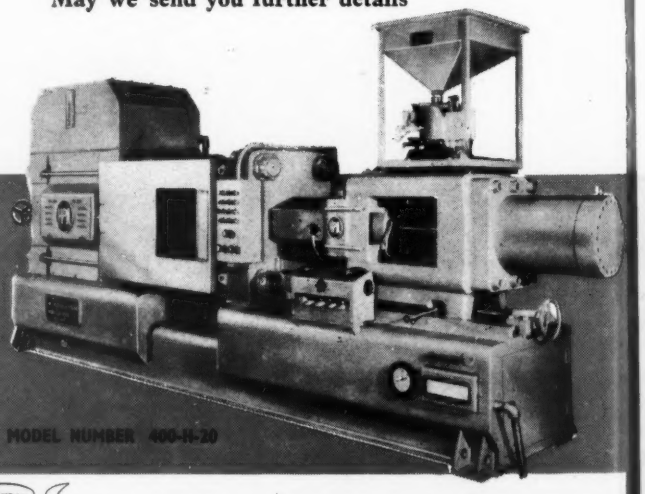
NOTE: All ratings based on moulding general purpose polystyrene

**From 6 ounces to 400 ounces; with mould clamping pressures from 150 tons to 3,000 tons . . . that's the scope of the new H.P.M. range.**

**Each machine is new, designed with many outstanding features. High capacity plasticizing chambers, weigh feeders, greater 'shot' capacities, increased daylight and stroke, quiet pumps, and sub-plate mounted valves reducing piping to the absolute minimum, are some of the reasons why H.P.M.'s mould better, faster and at lower cost.**

**They are famous for dependability too; designed by America's pioneer manufacturers of injection machines, each unit has 77 years' hydraulic machinery building experience behind it.**

**May we send you further details**



MODEL NUMBER 400-H-20

INTERNATIONAL MACHINE TOOL EXHIBITION 1956

**Other H.P.M. Models are available with these capacities:—**

**STANDARD**
Model 600-H-32 Capacity 32 ounces.
,, 1200-H-80 ,, 80/100 ,,

**PRE-PLASTICIZING**
Model 400-P48A Capacity 48 ounces.
,, 1200-P200 ,, 200 ,,
,, 3000-P400A ,, 400 ,,

**WICKMAN LIMITED**

FACTORED MACHINE DIVISION, FLETCHAMSTEAD HIGHWAY, COVENTRY

*Telephone: Coventry 40351*

402 P46

## QUANTITY PRODUCTION NO PROBLEM!

Many folk can produce a good idea once, or even twice - but who has the resources and experience to adapt it to mass production process and flawlessly reproduce it in quantities? Derwent can. And there comparison with the rabbit ends for the only thing a rabbit can produce is more rabbits, whilst Derwent tackle an enormous range of precision mouldings - and judging by repeat orders, with great success too! So if you have a problem in plastics why not ask our representative to call?

*Let Derwent do it!*

**PRECISION MOULDINGS BY**

**DERWENT PLASTICS LTD**

**STAMFORD BRIDGE, YORK. TEL. STAMFORD BRIDGE 294.**

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That's why we at ROOTES MOULDINGS find life so interesting. Our clients confront us with a diversity of problems to solve. It's right up our alley because, we can supply the complete solution within our own organization.
We design mouldings, make the tools and our craftsman, aided by the most up-to-date precision equipment, start production immediately.
The result—a first class job at a competitive price.
*For all plastic moulding problems consult us now-- we're confident we can help you.*

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*For all compression mouldings*

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The Pressed Steel Company Limited were looking fo
an attractive, functional easy-to-clean evaporator do
for their new Prestcold refrigerator.
It was our kind of job..... technicians and workmen
rolled up their sleeves—and here you see
the result, this high impact Polystyrene door.
Simple, streamlined, effective—altogether a pretty
good job. Leastways thats how our clients,
The Pressed Steel Company Limited feel about it—
and we at Rootes Plastics like to think so too.
*No matter how big or small, if your problem is plastics bring it to the Rootes door—you won't even have to knock.*

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OF THERMOPLASTIC MATERIALS
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POLYTHENE DIAKON

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# BANISH THESE TIMEWASTERS

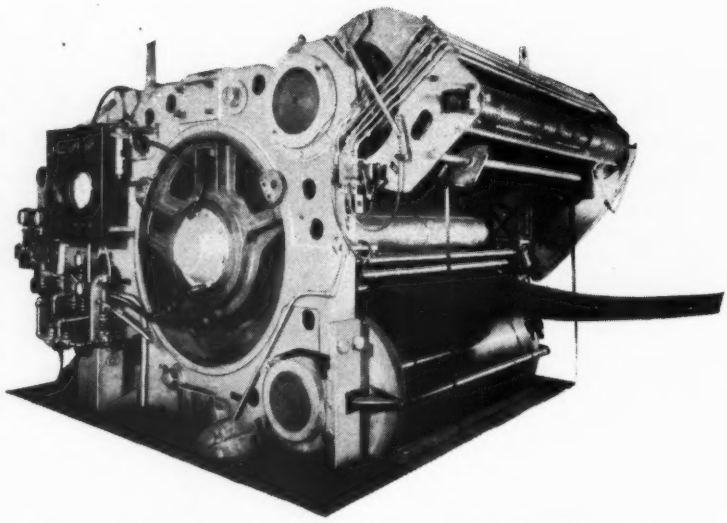
opening
cooling
reheating
closing

# KEEP PRODUCTION ROLLING

Eliminate the round of opening, cooling, re-heating and closing in your vulcanising or gelling processes and you eliminate all the time lags, increase production by a profit-telling proportion.

The Shaw Rotocure is the only machine which provides continuous operation in the production of belting, flooring, matting and similar flat products. In addition, there is perfect curing—no overlap areas, ease of changing the main vulcanising drum and all the outstanding features which come with Shaw experience.

We also make: INTERNAL MIXERS, EXTRUDERS, MIXING MILLS, ROTOCURE MACHINES, TYRE BUILDING MACHINERY, LABORATORY EQUIPMENT FOR RUBBER AND PLASTICS, PRESSES, ETC.



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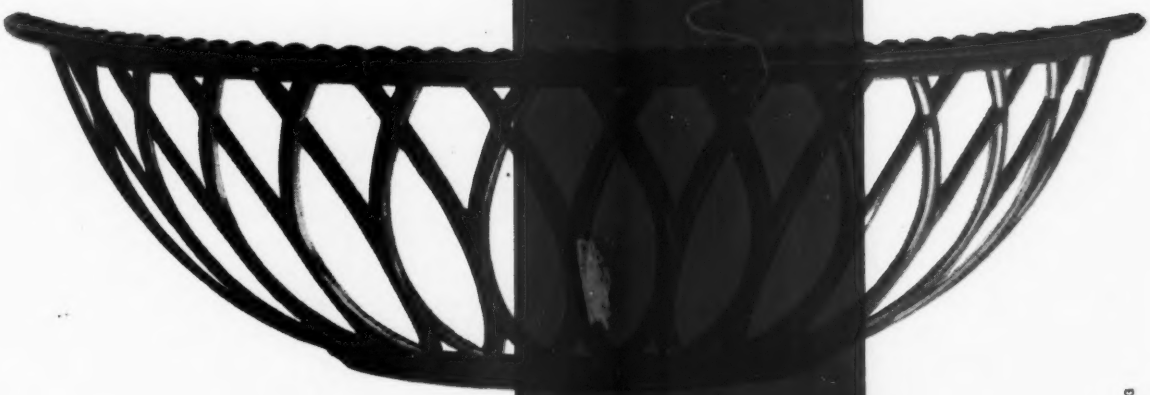
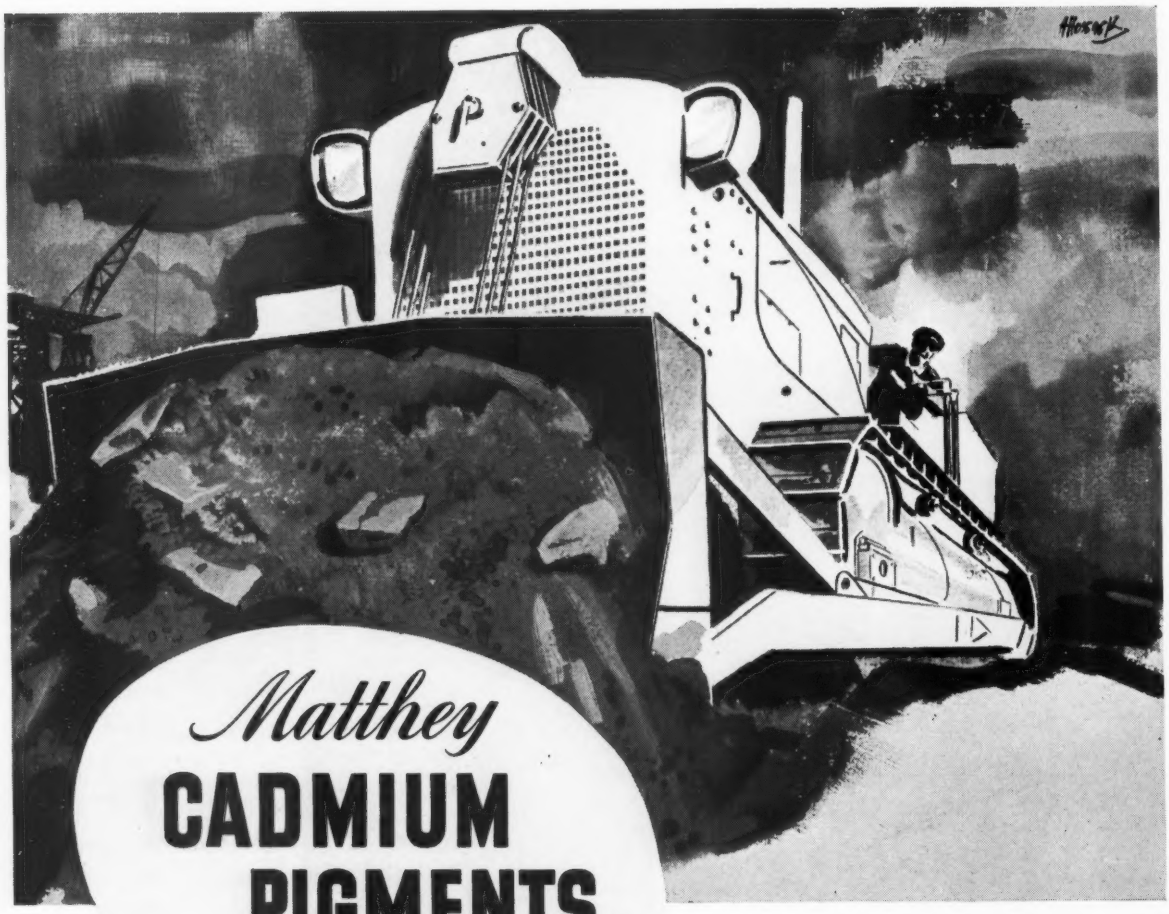


for colour and easy mould

walter bellmer VSG

S.I.C. Plastics Ltd. (Sole U.K. Concessionaires for Soc. Italiana Celluloide)
12 Whitehall, London, S.W.1 *Telephone:* Trafalgar 7337



# *Matthey* CADMIUM PIGMENTS

Why "bulldozers" should be painted in such brilliant colours is a matter for conjecture. But certainly machine and paint have this in common, that they must stand up to the most adverse conditions. Matthey cadmium pigments, ranging from bright yellow to deep maroon, are remarkable for their resistance to extremes of temperature and to exposure to strong light and chemical attack—obviously the ideal choice for all cases where the going is rough.

*Literature describing Matthey Cadmium pigments is available on request and enquiries on any colouring problem are welcomed.*

**Johnson Matthey**

JOHNSON, MATTHEY & CO., LIMITED, HATTON GARDEN, LONDON, E.C.1. Telephone: HOLborn 6989

P7.

# W.W.B. designed the Tools and produced the cabinet and accessories for this "Regentone" Portable

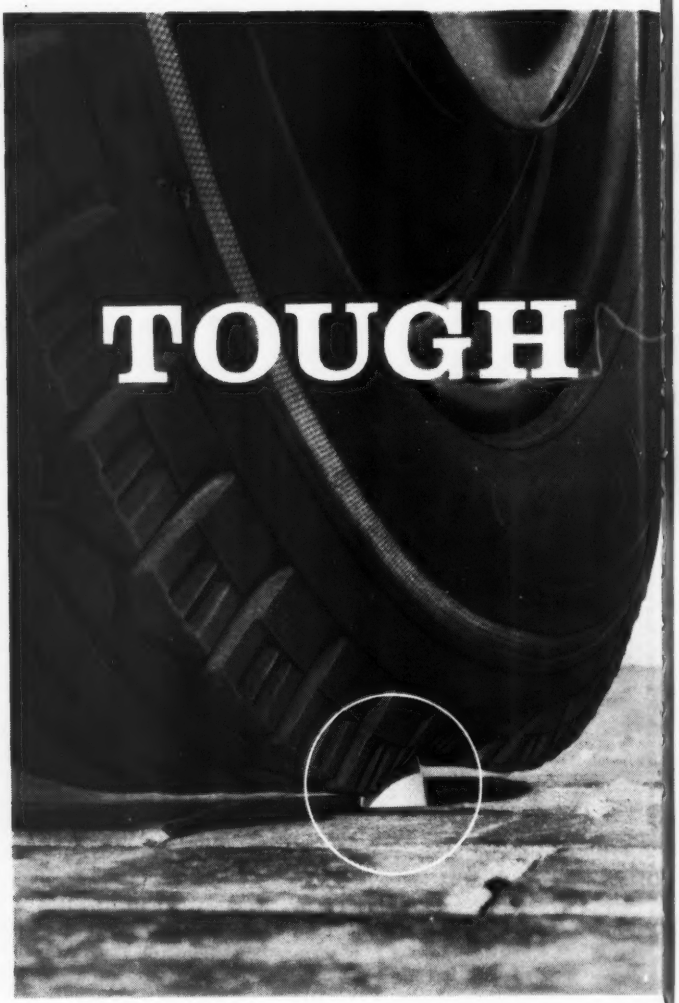
A typical example of the various operations carried out in the W.W.B. factory at Billericay, Essex. The Cabinet is in Red Phenolic . . . the accessories . . . Bezel in clear polystyrene . . . Socket and Plug in Black Phenolic . . . Extension Spindle in Polystyrene . . . Control Knob in Red Phenolic . . . Volume Knob, In-Out Switch, and M.W.-L.W. Switches in Cream Polystyrene . . . Gold Spray-Lining Colour Blocking-Lettering.

**W.W.BALL**
& SONS LIMITED

**BURSTEAD WORKS, KENNEL LANE, BILLERICAY, ESSEX**

Grams: **PLASTOOL BILLERICAY** Phone: **BILLERICAY 1133/4**

# HOW TOUGH



YOU WANT TO KNOW how T.11 is *different* —and the answer is simply that it's a great deal tougher. It's six times tougher than Lustrex General Purpose. It is in fact, the toughest polystyrene you can buy. This "super-tough" form of Lustrex retains the advantages of the other grades of Lustrex.

This new material, which is the same price as other impact grades and which does not require special moulding techniques, makes existing applications more attractive and opens up new prospects for low cost polystyrene mouldings.

***Your experience will tell you that T.11 is something you must know more about.***

# CAN A PLASTIC BE ?

**New Lustrex Toughened 11 withstands weight of 28 cwt. car . . . shows far greater Impact Strength, Deflection and Elongation at Break than any other polystyrene plastic ever made in Britain.**

**TECHNICAL DETAILS**

| Property | Units | Test Method | Lustrex T.11 |
|---|---|---|---|
| Tensile Strength | lb./in.$^2$ | ASTMD.638-52T | 3500 — 4500 |
| Elongation at Break | % | ,, ,, | 20 — 40 |
| Modulus of Elasticity in Tension | lb./in.$^2$ | ,, ,, | 2.5 — 3.5 × $10^5$ |
| Flexural Strength | lb./in.$^2$ | ASTMD.790-49T | 6500 — 8000 at yield |
| Deflection | ins. | ,, ,, | No failure (3″ span) |
| Izod Impact Strength | | | |
| ½″ × ⅛″ | ft./lb./in. of notch | ASTMD.256-47T | 2.2 — 3.2 |
| ½″ × ¼″ | | ,, ,, | 1.5 — 2.0 |
| Softening Point | °C | B.S.1493 | 84 — 88 |
| Specific Gravity | | | 1.05 |

*Lustrex is a Registered Trade Mark.*

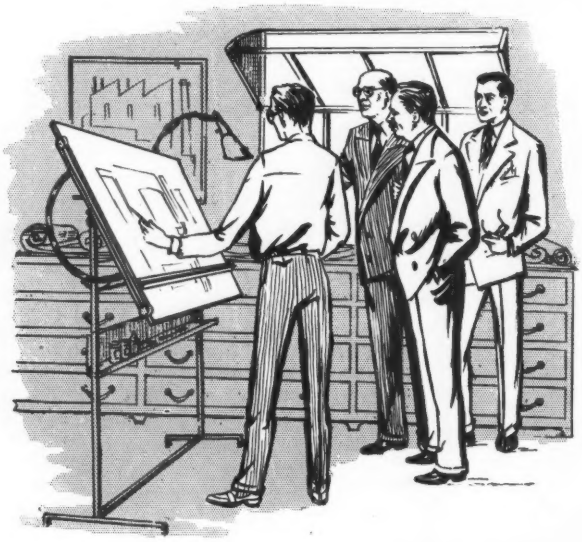
**MONSANTO PLASTICS LIMITED**

**Dept. 382, Victoria Station House, Victoria Street, London, S.W.1**
**and at Royal Exchange, Manchester, 2.**

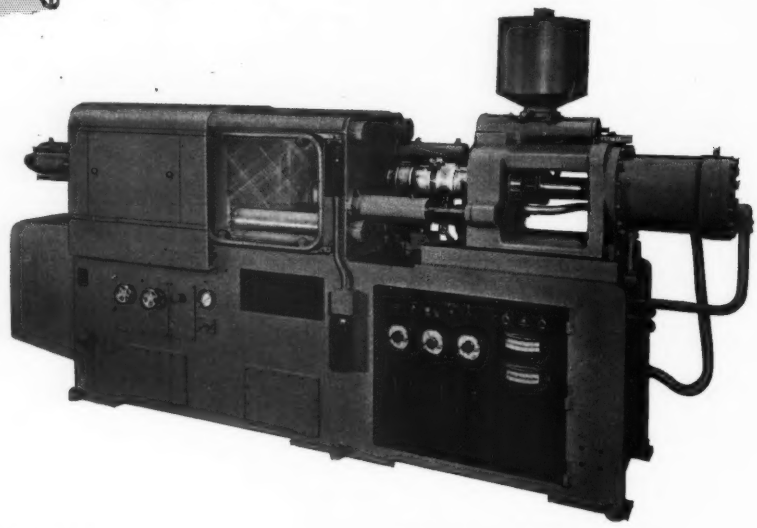
*In association with: Monsanto Chemical Company, St. Louis, U.S.A. Monsanto Canada Ltd., Montreal. Monsanto Chemicals (Australia) Ltd., Melbourne. Monsanto Chemicals of India Ltd., Bombay. Representatives in the world's principal cities.*

MONSANTO

Regd.



Manufacturers of plastics articles, whether small or large, will do well to consider how very effectively PECO Machines can serve them. PECO Machines are in fact installed by leading makers of plastics articles in this country and throughout the world. They give a steady flow of perfectly moulded articles, and are designed for economy of labour and ease of operation. PECO INJECTION MOULDING MACHINES are made in a range from 2 oz. to 160 oz. capacity.



*PECO 30m Injection Moulding Machine*

*Expert Advice gladly offered* *Illustrated Literature sent post free*

# PECO MACHINERY SALES

(Westminster) LIMITED

28 VICTORIA STREET · LONDON · S.W.1

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Works: THE PROJECTILE & ENGINEERING CO. LTD., ACRE STREET, LONDON, S.W.8

**PHENOL**

A high-quality synthetic product meeting the most stringent requirements of the plastics industry.

**XYLENOLS**

A grade of refined cresylic acid of distillation range approximately 215-230°C. Total tar acid content 99.5 to 100%.

*Availability:*

*Ample supplies for prompt delivery in road tank-wagons and in 40/45 gallon drums.*

*For further information, consult:*

**IMPERIAL CHEMICAL INDUSTRIES LTD., LONDON, S.W.1**

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# Current Beecham Achievements

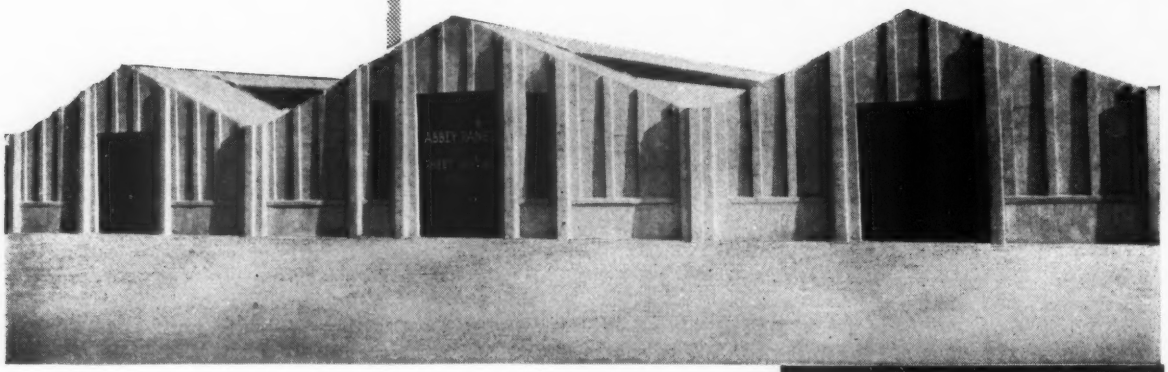
"My Board are most impressed by the way you completed the existing factory within the stated time and I would add that we are highly delighted with the finished building. It is very refreshing these days to get what you want, when you want it, without having to pay for a considerable amount of extras when you have got it. Your ability to execute this work so efficiently has helped us very considerably in meeting our own production commitments.

To meet additional requirements, I would appreciate it if you would quote me by return for extending the building by a further 20,000 sq. ft."

*The extracts quoted are from a letter written by E. Loades, Esq., Managing Director of The Abbey Panel & Sheet Metal Co. Ltd., Coventry and Bedworth.*

*. . . completed to schedule this factory illustrates another successful Beecham contract, undertaken during a period of maximum production and against adverse weather conditions.*

Concurrently Beecham Buildings have erected the largest prefabricated industrial building in the country; a 200,000 sq. ft. factory in the Midlands. Their new ways of building allow Beecham to keep the pace on all their numerous contracts. For technical efficiency and well studied economy in Industrial Building you are advised to consult Beecham Buildings Limited.



**BEECHAM BUILDINGS LTD.**

DEPARTMENT K

SHIPSTON-ON-STOUR, WARWICKSHIRE. Telephone: Shipston-on-Stour 315, 316 & 3287

**Beecham Buildings**

*Why not consult us on your industrial building programme? We shall be pleased to advise you.*

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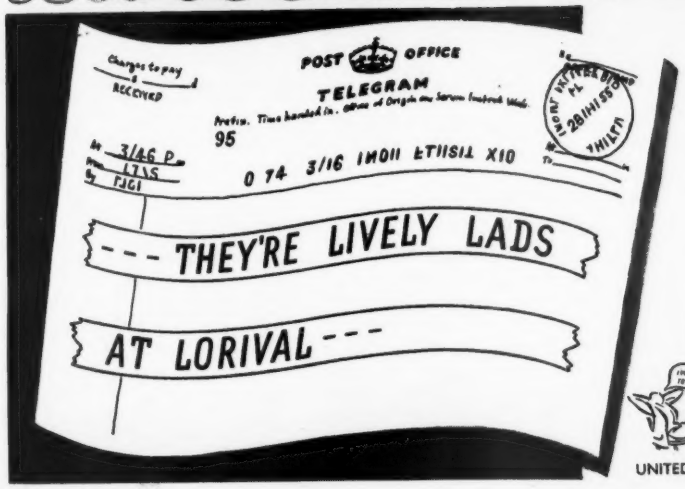


*Do you want your plastics post-haste? See the lively lads at Lorival. They've got all it takes when it comes to plastics. For low costs and express delivery, address your needs to 'Lorival'.*

## LORIVAL PLASTICS

UNITED EBONITE AND LORIVAL LTD., LITTLE LEVER, NR. BOLTON, LANCS.

**the plant men at Kleestron don't let the grass grow beneath them**

There's no 'out of this world' atmosphere at Kleestron where plastics are concerned. Lagos or Singapore, you'll find Kleestron material being used throughout the globe.

For the word has got around that there's none faster or more alive than the boys at the Kleestron plant. Order notes become despatch notes with a speed worth watching. It all adds up to service in a big way— you can rely on that when you're dealing with *Kleestron*.

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*Manufacturers of* —

**Kleestron H469** — High impact polystyrene in extruded or dry colourant pellets
**Kleestron Crystal 604** — dry colourant blend
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**Kleestron DS** — destaticized polystyrene
**Kleestron Standard Colour Range** — samples on request
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You've got to hand it to Metropolitan Plastics —when it comes to solving a Thermo-Setting Plastics problem.

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Reduce your handling costs. Lift and shift, quickly, safely, economically with KING Electric Pulley Blocks. Models to lift from 100 lbs. to 10 tons. Every model is tested to a 25% overload. Hook or trolley suspension.

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*Covered by British and Foreign Patents*

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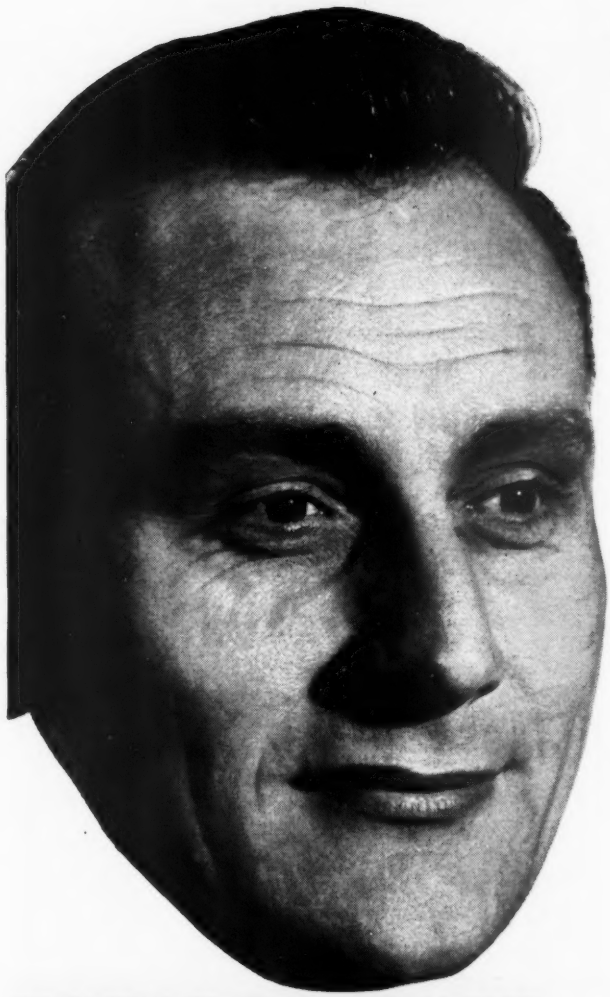

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For reduced costs . . for increased output . . for phenolic and urea grades suitable for every purpose—Rockite gets my order. Rockite moulding materials are available in a wide range of colours, mottles and wood shades in over twenty standard and special purpose grades. They are made by British Resin Products Limited whose experienced technologists are always ready to give detailed advice. With prompt delivery, assured quality, good technical service and a competitive price—the Rockite range is well equipped to meet all special and general purpose needs.

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**PHENOLIC AND UREA MOULDING MATERIALS AND EXTRUSIONS**

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**CHEMICAL DIVISION**

"Supertone" Urea Formaldehyde moulding powder in a practically unlimited range of colours, opaque and translucent. (Export only). Also "Supertone C", a Urea Formaldehyde moulding powder with a special cellulose filler resulting in mouldings of high transparency. (Export only).

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Moulds as well as special machinery for the plastics industry; also a Product Styling & Mould Design Service.

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Compression and injection moulding shops coupled with modern assembly and finishing units; Extrusion shops and a plastics bottle blowing department. Proprietary lines produced in this Division are:—

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This Division specializes in the manufacture of plant and of media for modern barrel-finishing processes for the plastics and metal industries. It has its own physical laboratory, where samples can be processed, and is supported by a Technical Advisory Service.

**The steady progress of Lacrinoid could not have been possible without an understanding of the customer's problem and the ability to satisfy his requirements in full**

*Current Programme shown on left*

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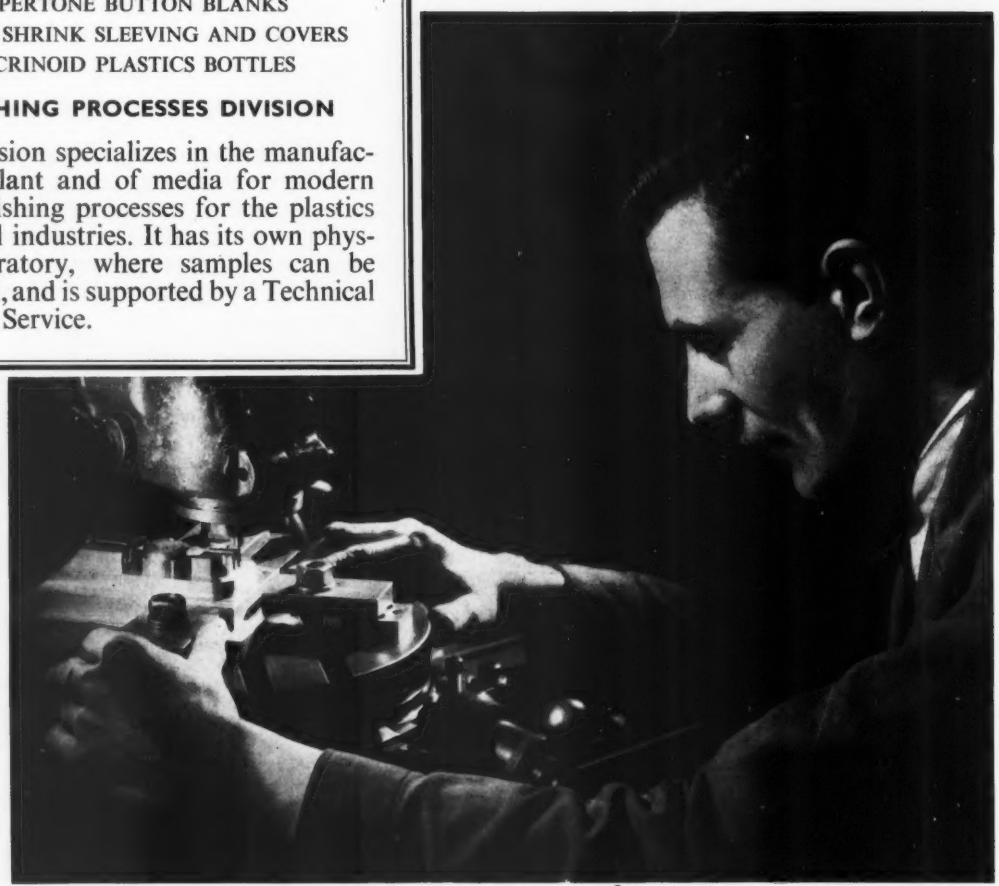

*Tool making is a highly specialized skill.*

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# 2 heads are better than one!

✱ "THE GREATEST THING ON EARTH IS MAN, THE GREATEST THING IN MAN IS MIND."

The head is responsible for your personal adaptability. Likewise, the head of the extruder determines the adaptability of your machine.

★ *Bring your problems to us—*
*TWO HEADS ARE BETTER THAN ONE*

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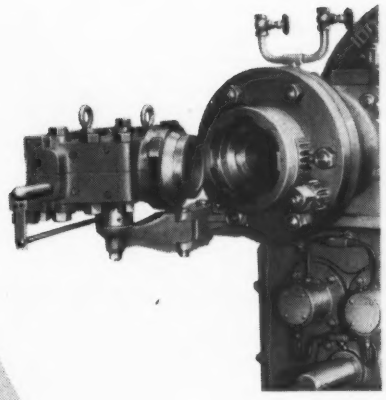
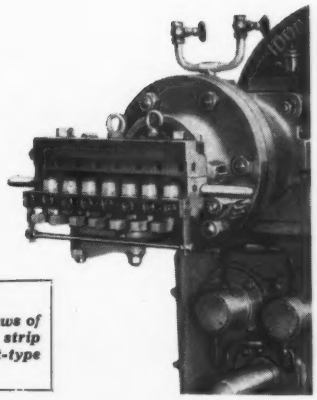
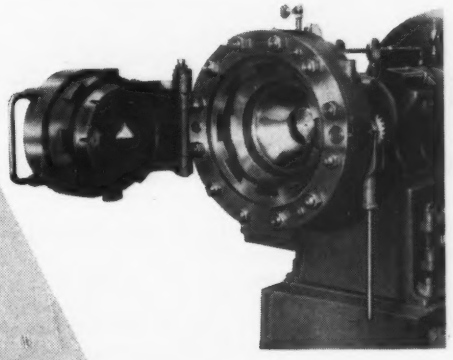
**TELEGRAMS: IDDON, LEYLAND**

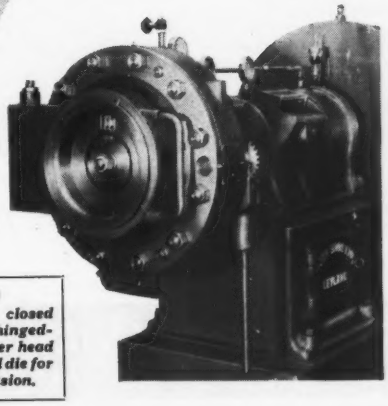
*Manufacturers of Mixing Mills, Presses, Calenders and Extruding Machines for Rubber and Plastics Industries*



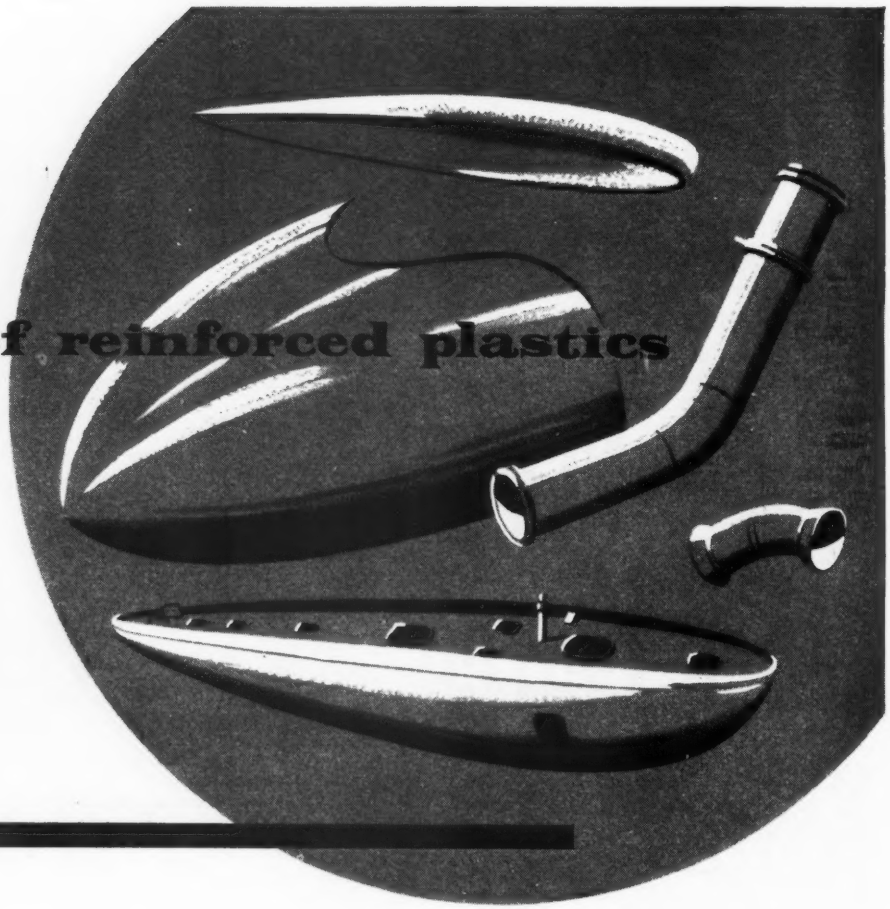


***BV. 4-5***
***Open and closed views of electrically heated strip head with a bayonet-type locking.***





***BS. 9-10***
***Open and closed views of hinged-type strainer head with special die for sheet extrusion.***



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D3

deep are the roots . . .

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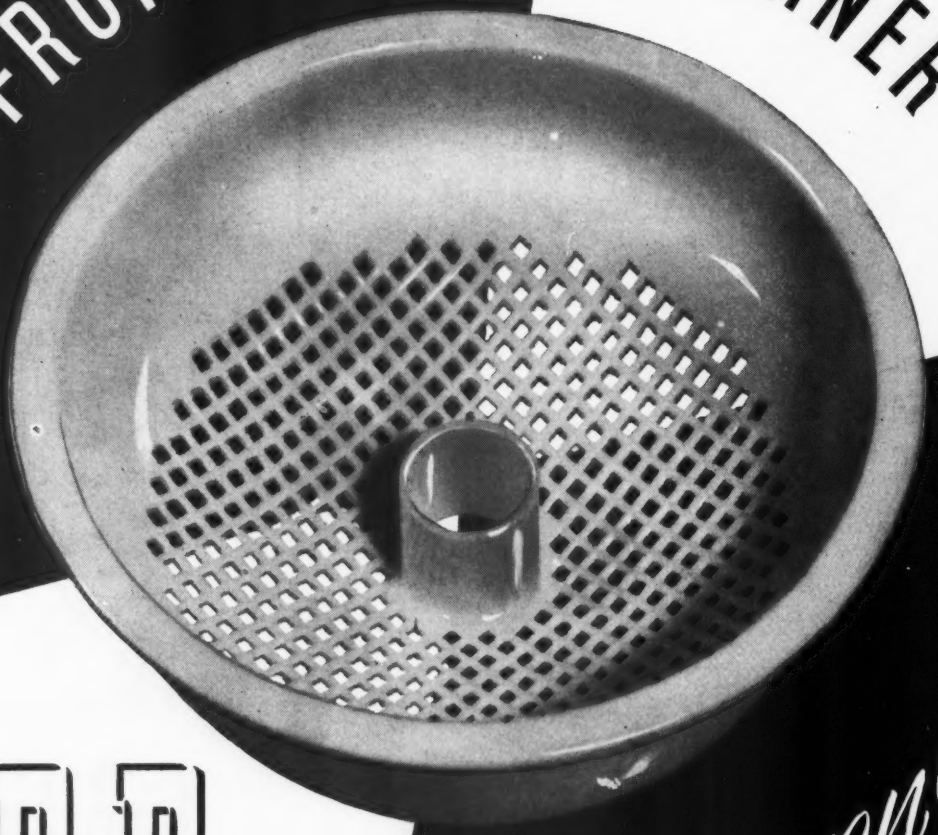
Forty years' experience in moulded plastics. That's the G.E.C. record in a still young and expanding industry. Planning and producing insulating components and moulded parts for a wide range of industrial and domestic products, the G.E.C. can place at your disposal mass production facilities backed by the intensive study of plastics, from the research laboratory right through to the finished article.

*This refrigerator tray in Polystyrene material is a typical example of the large variety of mouldings made by the G.E.C.*

# moulded plastics for industry

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C 2.

# FRUIT JUICE STRAINER



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# A.M.C. 422

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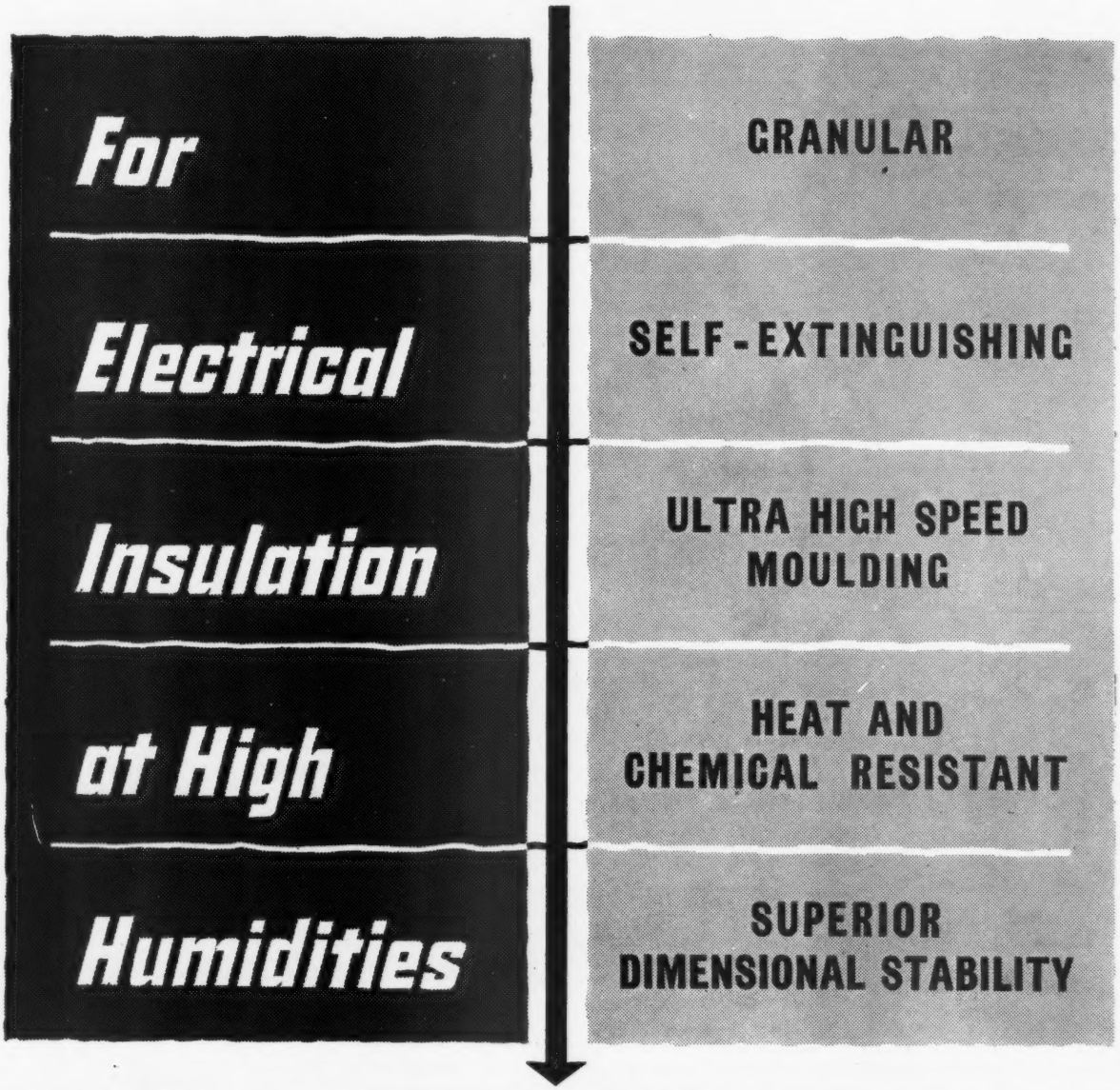


**PLASKON ALKYD MOULDING COMPOUNDS,** originally developed with such outstanding success for high electrical insulation work in the United States, are now manufactured under licence in England by **RESINOUS CHEMICALS LIMITED.** Samples gladly forwarded upon request.

**RESINOUS CHEMICALS LTD.**

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# masterpieces made to measure

*"Wouldst that thou had many hands, Master Humphrey, that thy skill could fashion a multitude of works".*

*Now times have changed. The modern master craftsman in metal is the toolmaker. The tool, like the suit of mail, is a "one-off job", but its products are legion. That is skill used to the best advantage. At Mitcham our many craftsmen fashion a variety of fine works — plastic moulds, press tools, jigs and fixtures — to order.*

*Masterpieces made-to-measure, in fact.*

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TOOLMAKERS TO THE PLASTICS INDUSTRY

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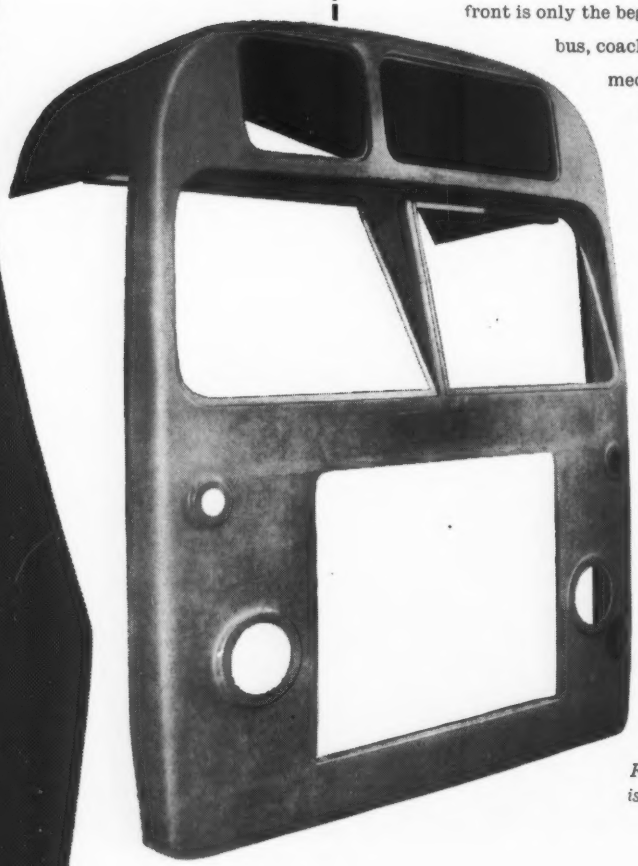
Embracing Completed Mouldings, Moulding powders, Resins, solid, powdered, or in solution, Insulating Varnishes, Cements, Lacquers, Anti-friction resins for fabric bearings, Capping cements, Filling Compounds, Sealing fluids.

*London Office: 79 Baker Street, W.1.*

# Moulding the future...



The complex curved front of this single-decker model S.14 is moulded in one piece of Fibreglass reinforced plastic. Yet the front is only the beginning of the story. Right down the bus, coachwork curves are shaped without mechanical aid, without high pressures—with F.R.P. This easy method is saving the Birmingham and Midlands Motor Omnibus Co. Ltd. up to 50% on certain former construction costs. It is reducing fuel consumption too.

It has an exceptionally high strength weight ratio. On every bus, it saves 56 lbs — which in terms of fuel saving is well worth having, when you multiply this by a whole fleet, by every year.

F.R.P. is not only moulding the buses of the future, but is being used to replace damaged curved sections on Midland Red's existing fleet of 1800 vehicles—its ease and cheapness of fabrication helping to get them out of the repair shop, back into service at low cost, in quick time.

*Fibreglass have an FRP advisory service which is expert, confidential and free.*

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**the backbone of Reinforced Plastics**

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# We helped ourselves

. . . and not for the first time, of course. We're referring to the cabinet for the new Ekco Radiotime, and when you see it (as you almost certainly will) you will agree that it was well worth helping ourselves to. Our radio people wanted a cabinet good-looking, light, and strong, in which to put a 5-valve radio and a clock. We provided the cabinet you see below, moulded in polystyrene in a choice of colours—ivory or dove-grey, with a smooth, lustrous finish. A really distinctive moulding. And what we can do for Ekco we can do for you—consult EKCO PLASTICS first, for really fine mouldings.

**Technically speaking**

Overall dimensions of the cabinet are 8″ high x 12¼″ x 5″. Four internal bosses take self-tapping screws and, to prevent sinkage, pre-formed inserts are used, so avoiding undue changes in section thickness. It is moulded in polystyrene, with a shot weight of approximately 23 oz.

**EKCO** plastics for industry

E. K. COLE LTD. (PLASTICS DIVISION), SOUTHEND-ON-SEA • ESSEX

*Members of the British Plastics Federation*

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# VINATEX P.V.C. COLOUR CONCENTRATES

VINATEX Colour Concentrates are flexible P.V.C. Compounds in granular form containing a high proportion of pigment. They are especially manufactured for colouring natural " Vinatex " P.V.C. Compounds during extrusion.

VINATEX P.V.C. Colour Concentrates are available in an extensive range of standard colours, and alternative shades can be produced by blending the concentrates as required.

The Colour Concentrate and natural VINATEX P.V.C. Compound are easily blended before extrusion by the simplest technique. During the extrusion process, the granules are masticated and thoroughly mixed to give extrusions of uniform colour.

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Compounds are supplied in the form of chips or uniform pellets for all applications including Extrusion, Injection Moulding, Gramophone Records and Calendered Sheeting.

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V.39

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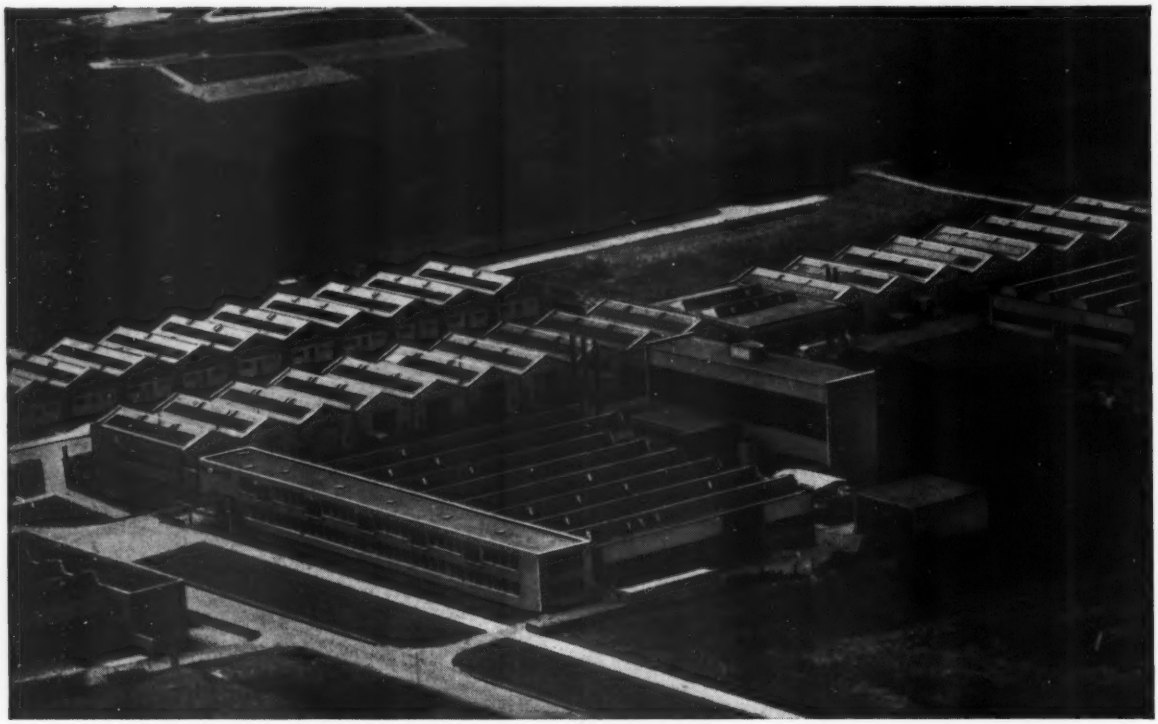
# 44 factories at HARLOW New Town all ventilated by COLT

FREDERICK GIBBERD ESQ. F.R.I.B.A., M.T.P.I.,
ARCHITECT PLANNER, THE HARLOW DEVELOPMENT CORPORATION.



This is one of several National industrial developments where COLT Ventilation equipment has been used. Others have been the Silicosis, Advance and Standard Factory Programmes and the Ex-Wartime Factories involving 96 Factories under Sir Percy Thomas & Son, F/A.R.I.B.A., The Wales and Monmouthshire Industrial Estates where for twenty-six factories COLT Ventilation equipment was specified by Jonah Arnold & Smith. The Remploy Factory Programme under the Ministry of Works where nearly one hundred factories were ventilated by COLT.

COLT Ventilation equipment has also been specified for many further contracts on Industrial Estates at Slough, Stevenage, Crawley, Trafford Park; for the Northern Ireland Advance Factory Programme, Scottish Industrial Estates, The Ministry of Supply Factories and Irish Estates Ltd.

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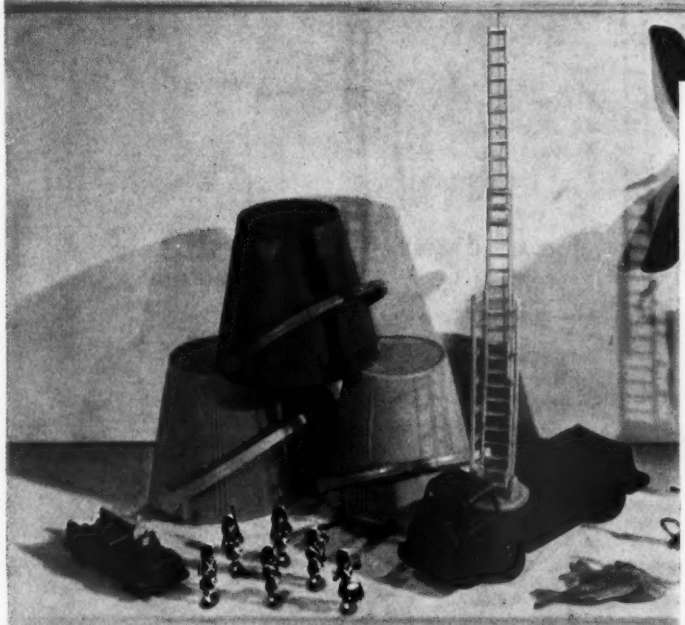
*Agents in Australia, Belgian Congo, Canada, Cyprus, India, Indonesia, Madagascar, Malaya, Mauritius, New Zealand, Pakistan, Portugal, North and South Rhodesia and South Africa.*



# Easy-to-mould 'Alkathene'

'Alkathene' brand of polythene is very easy to mould into intricate, hygienic, tough and gaily coloured children's toys . . . toys that are light in weight, *will not shatter* and being pliable, cannot hurt children if they fall on them.

Polythene has the lowest specific gravity of any plastic in the world and it is now one of the most economical.

*Polythene was discovered, developed, and is sold under the trade mark 'Alkathene,' by*

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P.595

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A Greenwich PRODUCT

## makes fashion rainwear news with 'Alpaca' effect

'Alpaca' is one of the exciting new printed and textured effects in Craymac plastic sheeting. Colours and textures are alike permanent, and add wonderful fashion possibilities to Craymac. Send for pattern folders showing the full range, which includes Donegal tweed effects and a new metallic 'Raindrop' print. Craymac is manufactured to British Standards Institution Specification No. 1763.

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*Telephone: Ravensbourne 4674/5 and Orpington 25671/2/3*

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From small beginnings Formaldehyde has become a bulk requirement in modern industry. And Ashworth, the *first* commercial producer in the U.K. has kept in step with its development. Today, we offer quick delivery of Formaldehyde, of consistently high standard in any required quantity. If you are interested, please write for new booklet which gives complete specifications and useful notes on handling and storage of Formaldehyde. And if you need us urgently for deliveries or for technical advice our phone number is easy to remember.

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FOR

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FERN HILL CHEMICAL WORKS

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*For further information and technical data*

**Write for this booklet**

Φ2

# Catering for the 'Heavy Insert'

So irresistible did Debroy Gourmet find the succulent oyster that he was wont to consume stacks of them without even bothering to remove their shells, much to the annoyance of the oysters themselves, who were conditioned to being unclothed before despatch. It did not do Debroy much good either!

The constant passage of unyielding shellfish decayed his teeth and necessitated their replacement by plastic substitutes. Even these failed to stay the course; teeth chipping off at every meal, until his mouth looked more like a rockery than anything else.

Being a seafaring man, it was easy for Debroy to lash these tooth-fragments to their plastic moorings with nylon fishing-line made fast with a blood-knot! His teeth neither chipped nor broke again.

He called at our Works one day, and our Technical Director noticed the result of this accidental combination of plastic and nylon; how the nylon gave elasticity to the plastic plate and so accommodated "heavy inserts" without any ill-result.

He hurtled off to invent "NESTORITE" Grade A.864, a perfect nylon-filled moulding powder, most suitable for mouldings carrying "heavy inserts."

YOU'RE RIGHT WITH 'NESTORITE'

**NESTORITE** **GRADE A.864**

*(Patented)*

## ELECTRICAL LOW LOSS

| | |
|---|---|
| Filler | Nylon Modified |
| Particle size (inches) | 3/8 flake |
| Specific Gravity | 1·22 |
| Bulk factor | 3·5—4·5 |
| Powder density | 0·25—0·35 |
| Time of cure of test cup (secs.) | 75—85 |
| Recommended flow range | 15—20 |
| Shrinkage (thou./inch) | 13·0—15·0 |
| Flowability (cm.) | 9—10 |
| Brinell Hardness | 30—35 |
| Coefficient of expansion of moulding per°C. | 0·000058 |
| Impact strength (ft./lb.) | 0.15—0.25 |
| Crossbreaking strength (lb./sq. in.) | 10,000—10,500 |
| Tensile strength (lb./sq. in.) | 6,000—8,000 |
| Elastic modulus in tension (lb./sq. in.) | $4 \times 10^6$ |
| Water absorption (7 days) (mg.) | 40—100 |
| Dimensional stability in water (thou. per in. of mldg.) | 6 |
| Dimensional stability in air (thou. per in. of mldg.) | Negligible |
| Plastic yield grading (°C.) | 100 |
| Blister temperature (50°C. per hr. rise) | 175 |
| Electric strength at 90°C. minute value (V/mil.) | 30—100 |
| Surface resistivity after immersion ($\log_{10}$ohms) | 11·5—12·5 |
| Volume resistivity (as moulded) ($\log_{10}$ohm cm.) | 12—14 |
| Power factor at $10^6$ c/s | 0·015—0.02 |
| Permittivity at $10^6$ c/s | 3.7—4.2 |

A phenolic material concerning nylon as a filler and modifier with exceptionally long flow, flexibility, a measure of impact resistance, good machinability and high electrical properties (at normal temperatures).

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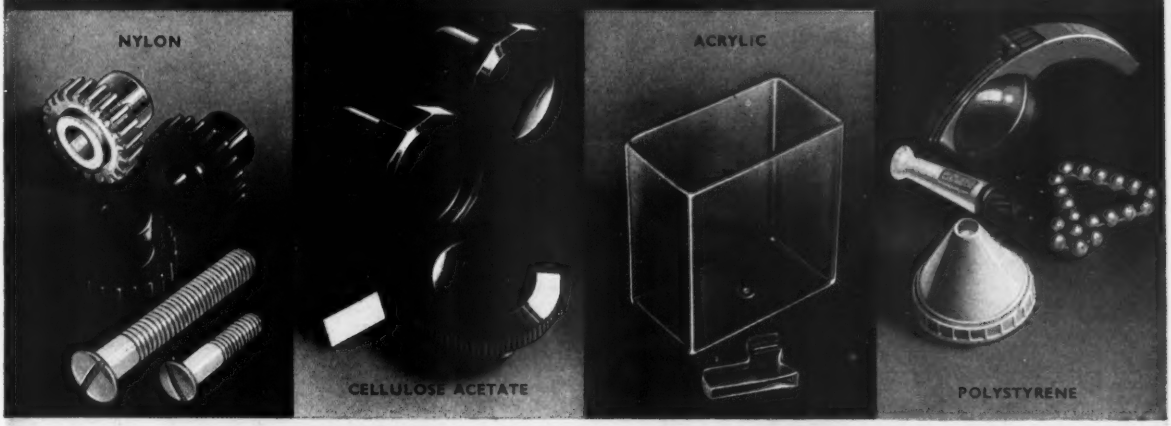
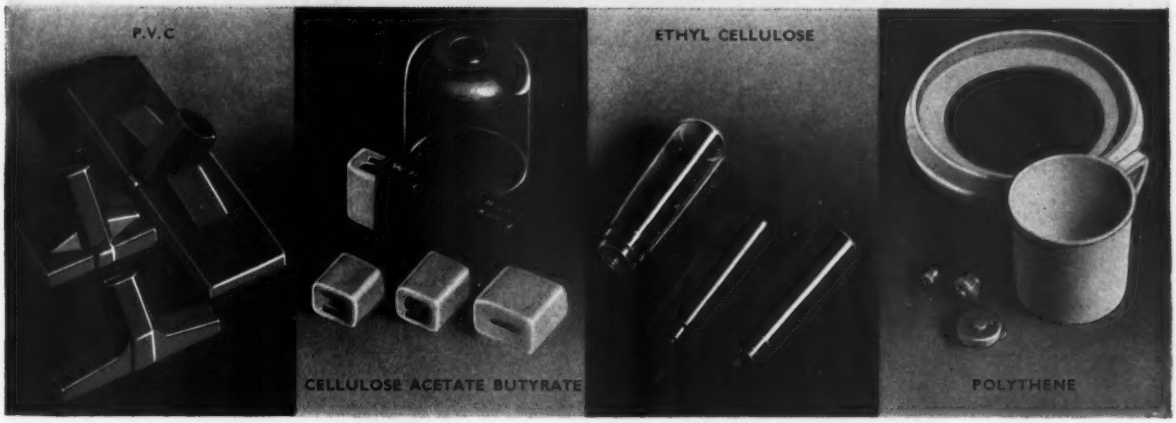
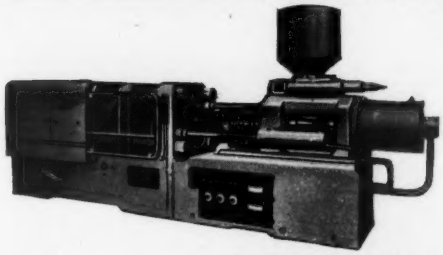
# Insulators Ltd




# injection mouldings



**INJECTION MOULDING MACHINE**

Insulators Limited are fully equipped to supply INJECTION MOULDINGS in quantity in the widest variety of materials and designs using modern plant and equipment with machine capacity ranging from 1–32 ozs. Illustrated above are a few examples of the extensive range of Thermoplastic materials in which Insulators Limited produce components. Their experience extends over 25 years and embraces every branch of plastic moulding technique. All the unique skill and comprehensive technical knowledge of Insulators Limited are at your disposal.
Inquiries are invited and will receive prompt attention.

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*BRANCH FACTORIES: JARROW, DURHAM, AND PADDOCK WOOD, KENT*
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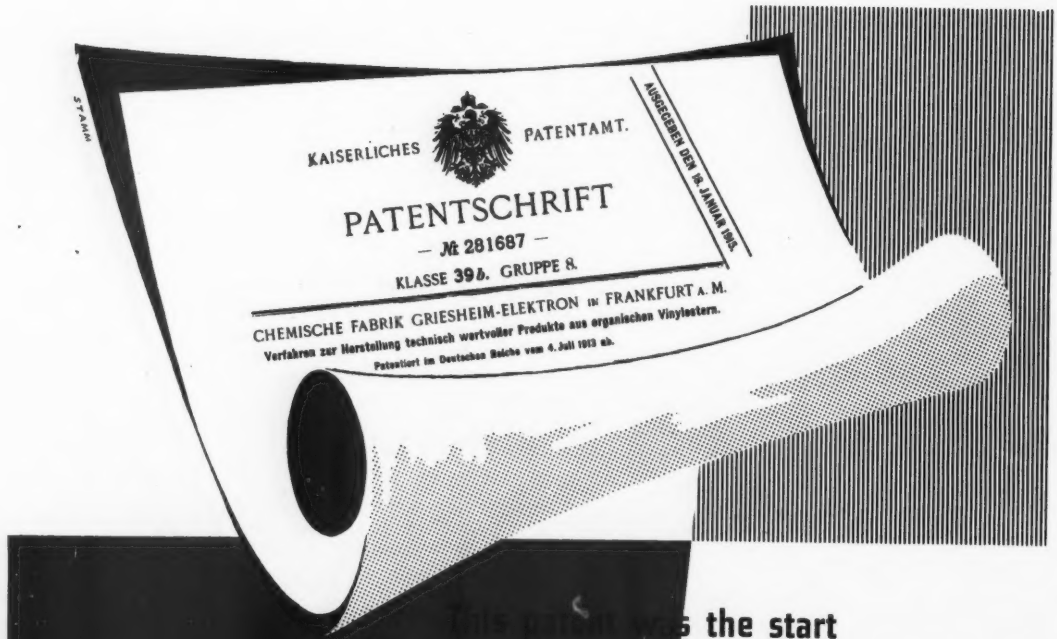
KAISERLICHES PATENTAMT.
PATENTSCHRIFT
— № 281687 —
KLASSE 39b. GRUPPE 8.
CHEMISCHE FABRIK GRIESHEIM-ELEKTRON in FRANKFURT a. M.
Verfahren zur Herstellung technisch wertvoller Produkte aus organischen Vinylestern.
Patentiert im Deutschen Reiche vom 4. Juli 1913 ab.
AUSGEGEBEN DEN 16. JANUAR 1915.
STAMM

This patent was the start

*The HOECHST range of plastics comprises at present:*

| | |
|---|---|
| MOWILITH polyvinyl acetate | *furthermore as auxiliaries:* |
| MOVIOL polyvinyl alcohol | URESIN B |
| MOWITAL acetal of polyvinyl alcohol | TRICRESYL PHOSPHATE |
| HOSTALIT polyvinyl chloride | TRIXYLENYL PHOSPHATE |
| HOSTALEN low-pressure polyethylene | INFIRNOL |
| HOSTAFLON polytrifluorochloroethylene | WAXES FROM GERSTHOFEN |
| ASPLIT as compressed resin | CHLOROPARAFFIN |

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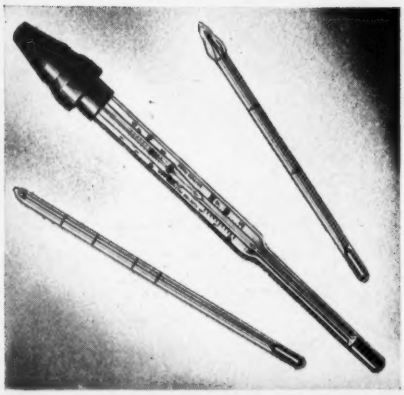

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ENGINEERS TO THE RUBBER & PLASTICS INDUSTRIES

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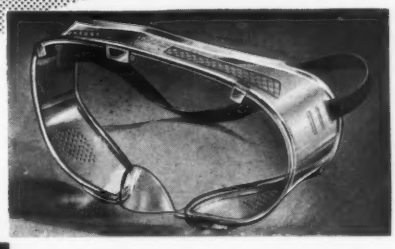

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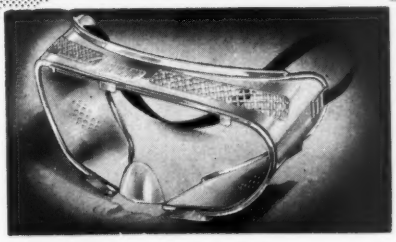
*"BIRFLEX" MAJOR*
*For wearing over spectacles. 6/- each.*
*Replacement windows 1/9 each.*



*E1601 "BIRFLEX"*
*5/- each.*
*Replacement windows 1/6 each.*

Every year, 200,000 painful eye injuries occur in British Factories. You may ask why this should be so when every worker has free access to protective goggles.
The answer is simple. Uncomfortable safety equipment is soon discarded. When we produced the range of Birflex goggles we rated comfort almost as important as protection. Polythene was chosen for the frames, it is tough, but pliable. Close fitting was essential and a soft material capable of being moulded to facial contours was required. Ventilation grids were incorporated to eliminate condensation. Cellulose acetate was selected for the windows, it has high impact strength and perfect clarity. And, because somebody has to foot the bill, we made the windows replaceable. Their price is **60/-** a dozen, extra windows **18/-** a dozen. Spectacle wearers were not forgotten and the Birflex Major was designed to give them complete protection.
They sell at **72/-** per dozen, extra windows **21/-** per dozen.
All of which goes to prove that if you want help in designing plastic mouldings to suit a particular set of circumstances, at an economical price, we are well-equipped to help you.

E. Elliott LIMITED
THE MOULDERS WITH THE ENGINEERING BACKGROUND

*helping to reduce eye accidents from 200,000 per year*

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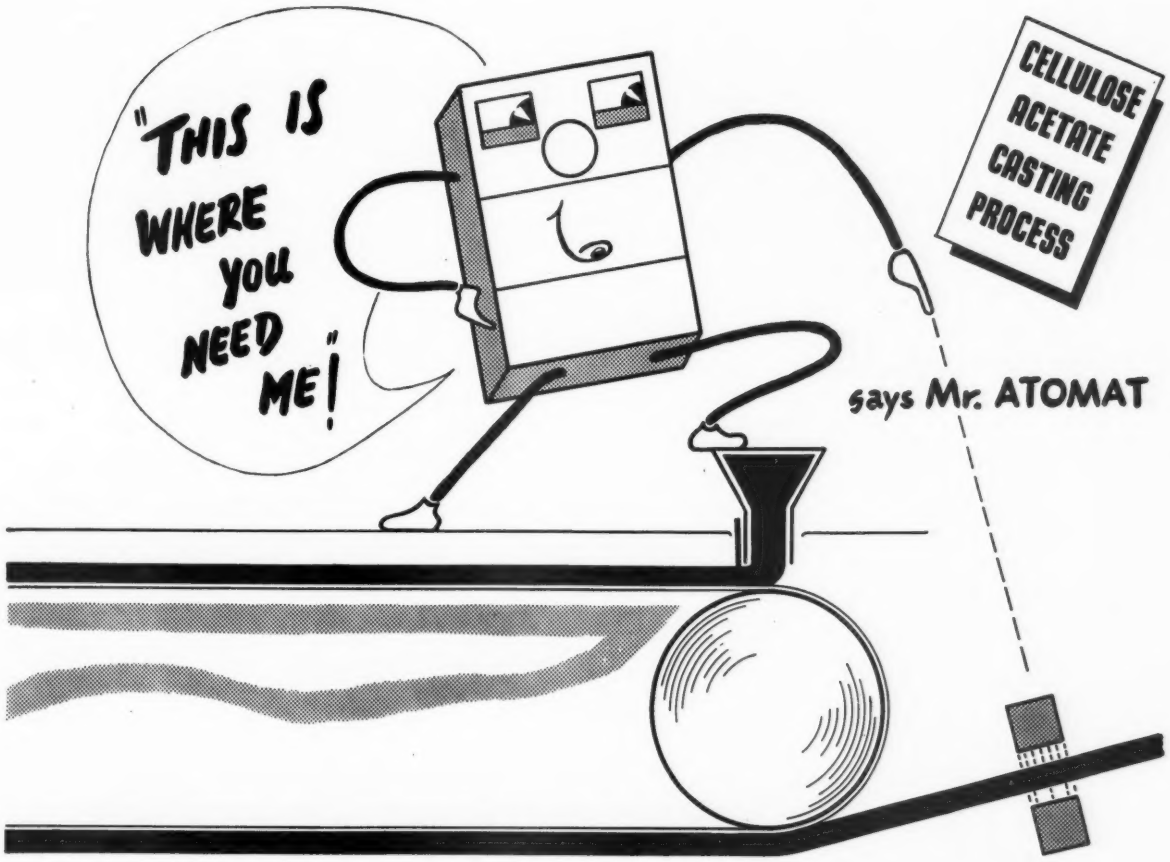


The use of the ATOMAT Beta Gauge in CELLULOSE ACETATE CASTING PROCESSES is but one of the many applications to thickness measurement in the Plastics Industry. Gauges can be supplied to measure from approx. 10 gr./m². (0.0004 inch) upwards. The ATOMAT indicates and records transverse and longitudinal profile of the film and thus discloses :—

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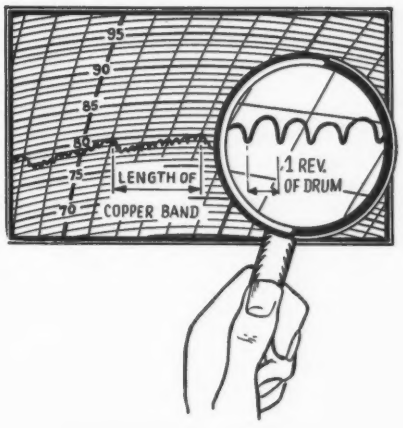


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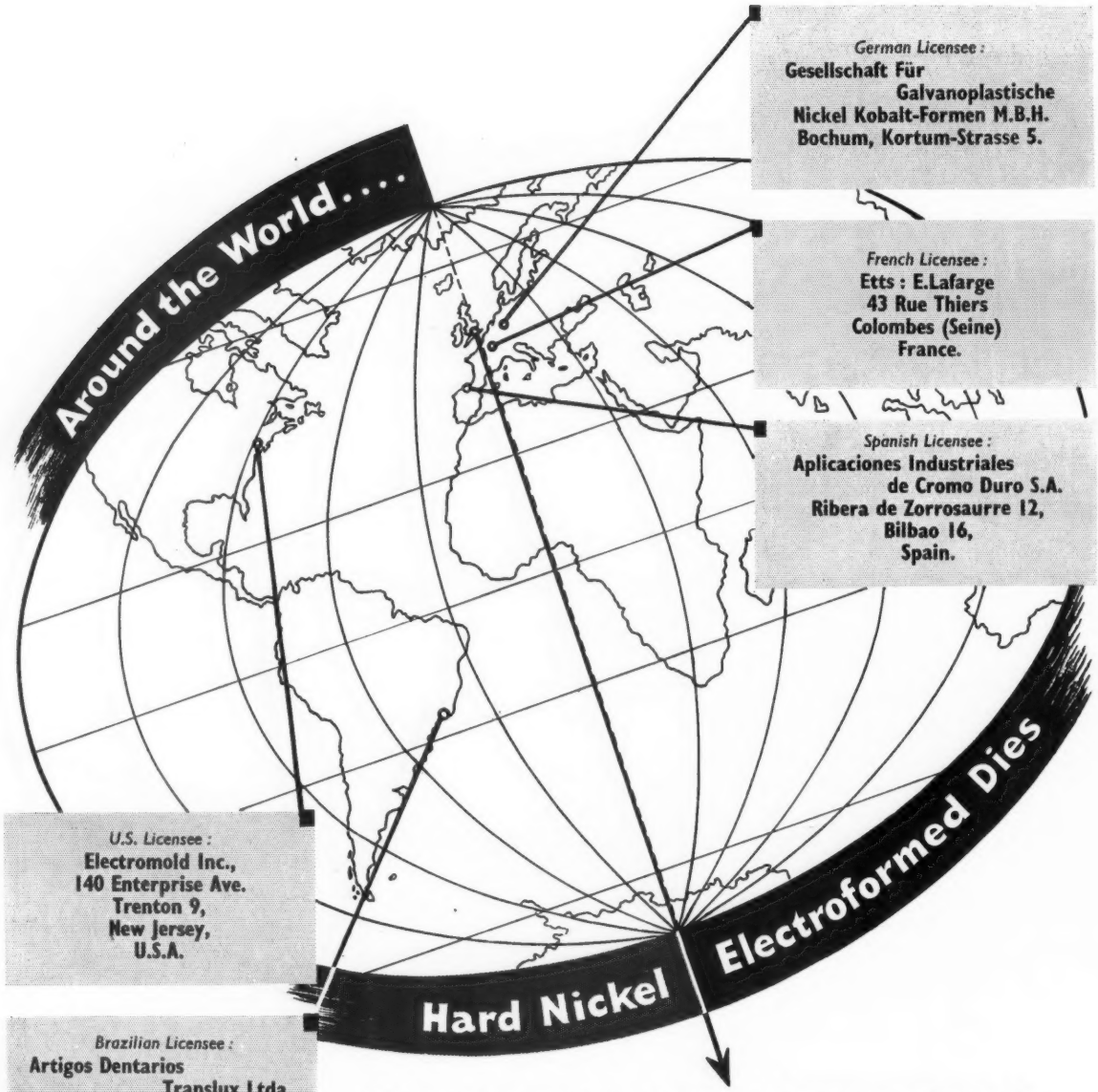


*Originated and made by the British Company, and now also produced under licence abroad, Electroformed Dies are reducing costs and raising production everywhere. Agents in Sweden, Denmark, Greece, New Zealand, Canada, Argentine.*

Hard Nickel Electroformed Dies need no heat treatment, they are made in one piece, to a tolerance equal to the accuracy of the master and they save often 20% to 80% on die costs by other methods. Particular advantages are shown when intricate detail, relief work, surface textures and undulating flash lines are required. The main applications are for injection moulding of thermoplastics, slush casting of P.V.C., blowing of decorative Polythene bottles and moulding of acrylic teeth. Typical components which call for Electroformed Dies are nylon gear wheels and worms, three-dimensional motifs, reflectors, fountain pen parts, mechanical toys. Mouldings produced from electroformed cavities are used extensively in the Textile Machinery, Automobile, Electrical, Toy, Office Machine and Aircraft industries. Please write for literature.

***. . . intricate cavities (or complete tools) for injection mouldings, etc.***

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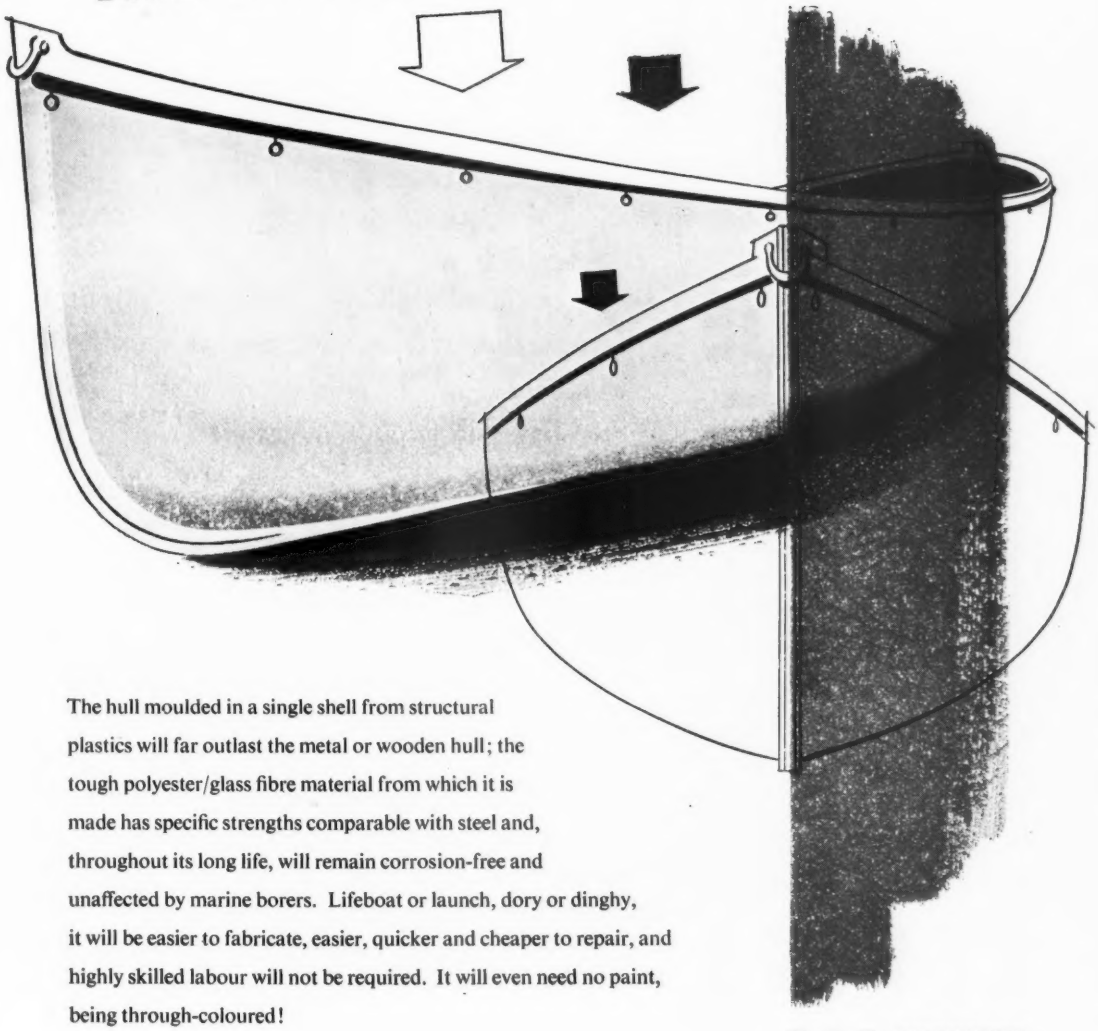
**MACaulay 5575 (5 lines)**

# This lifeboat will have nine lives!



The hull moulded in a single shell from structural plastics will far outlast the metal or wooden hull; the tough polyester/glass fibre material from which it is made has specific strengths comparable with steel and, throughout its long life, will remain corrosion-free and unaffected by marine borers. Lifeboat or launch, dory or dinghy, it will be easier to fabricate, easier, quicker and cheaper to repair, and highly skilled labour will not be required. It will even need no paint, being through-coloured!

Consider carefully these six money-saving points —then get in touch with B·I·P

- **EASIER TO FABRICATE** *by moulding in a single shell.*
- **EXCEPTIONALLY LONG LIFE** *and low maintenance costs.*
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- **CHEAPER TO REPAIR** *and quicker, too.*
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The full resources of the B·I·P Research, Development and Technical Service Departments are freely at the disposal of ship owners and boat builders interested in structural mouldings for the production of lifeboats, tenders and other small craft.

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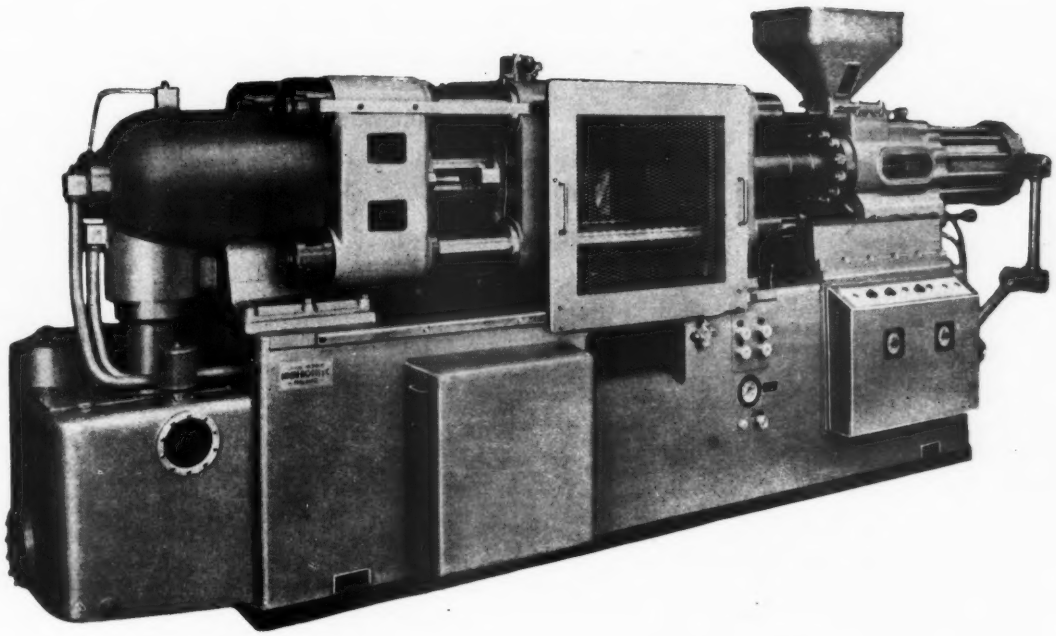
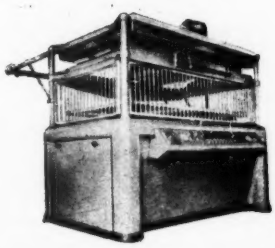
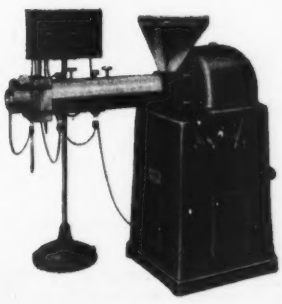
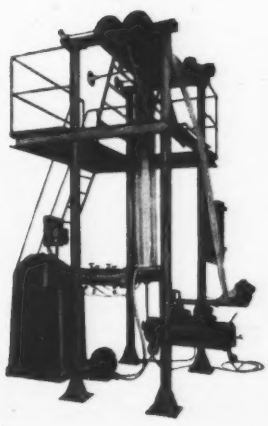


"Vuotoplast" - Vacuum Forming Machines



Extruding Machines and Equipments





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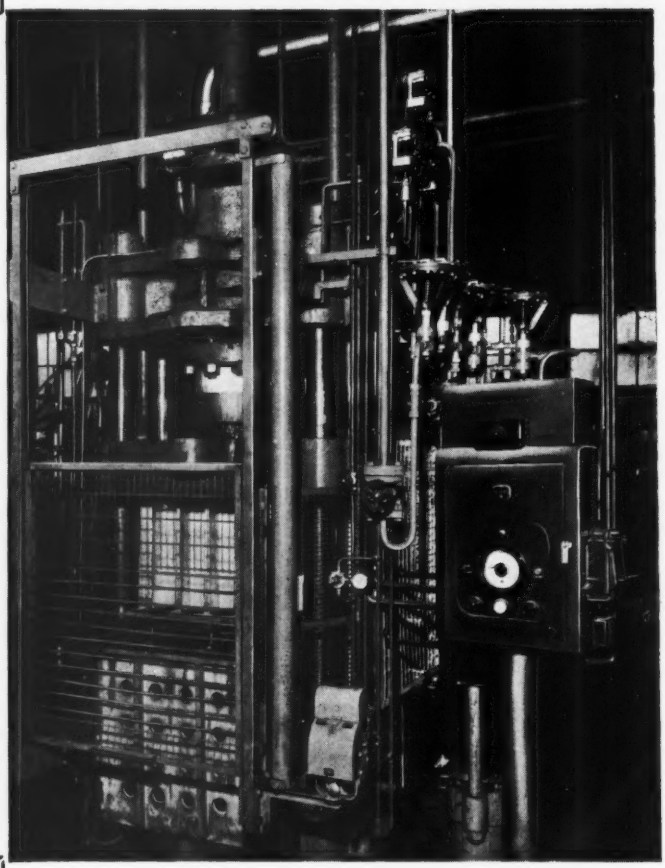
This hydraulic moulding press installed at Witton Moulded Insulation Works (proprietors General Electric Co. Ltd ) and used in the manufacture of plastic mouldings, is controlled automatically and continuously by a Bristol's 500 Series Cycle Controller operating in conjunction with Bristol's Hydraulic Control Valves.



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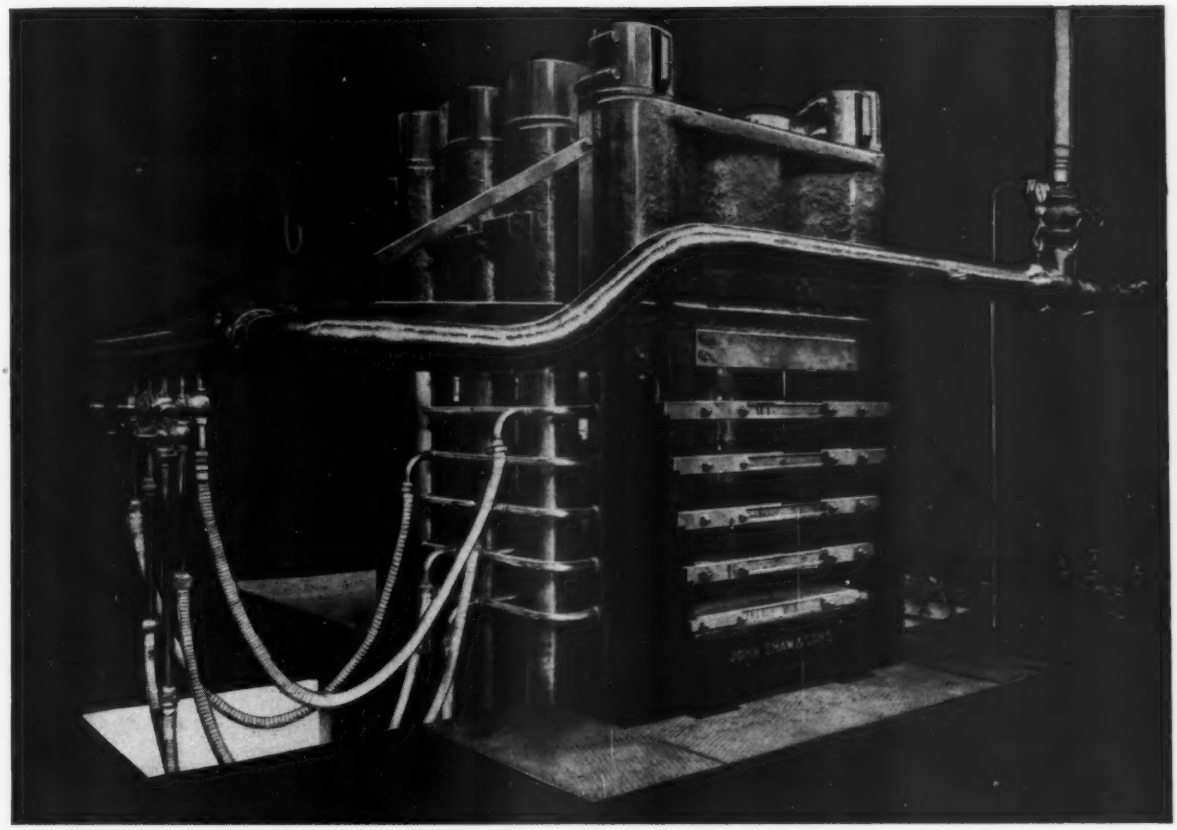

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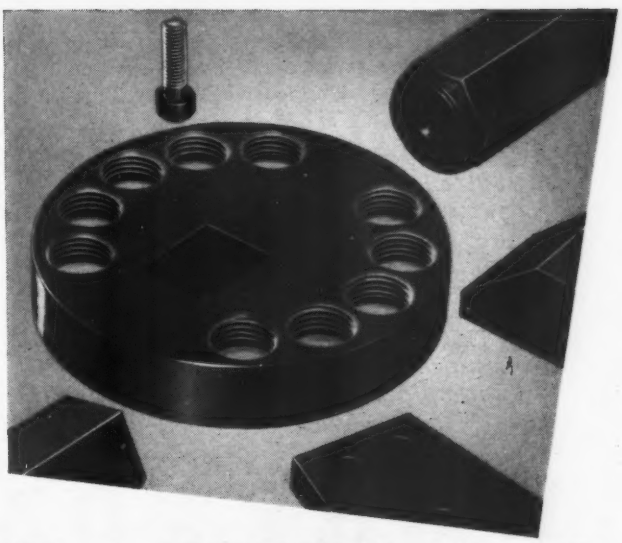

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"'*Cause they're made to what the textbooks would call 'a high engineering specification' and are 'of fundamental sound design.'*"

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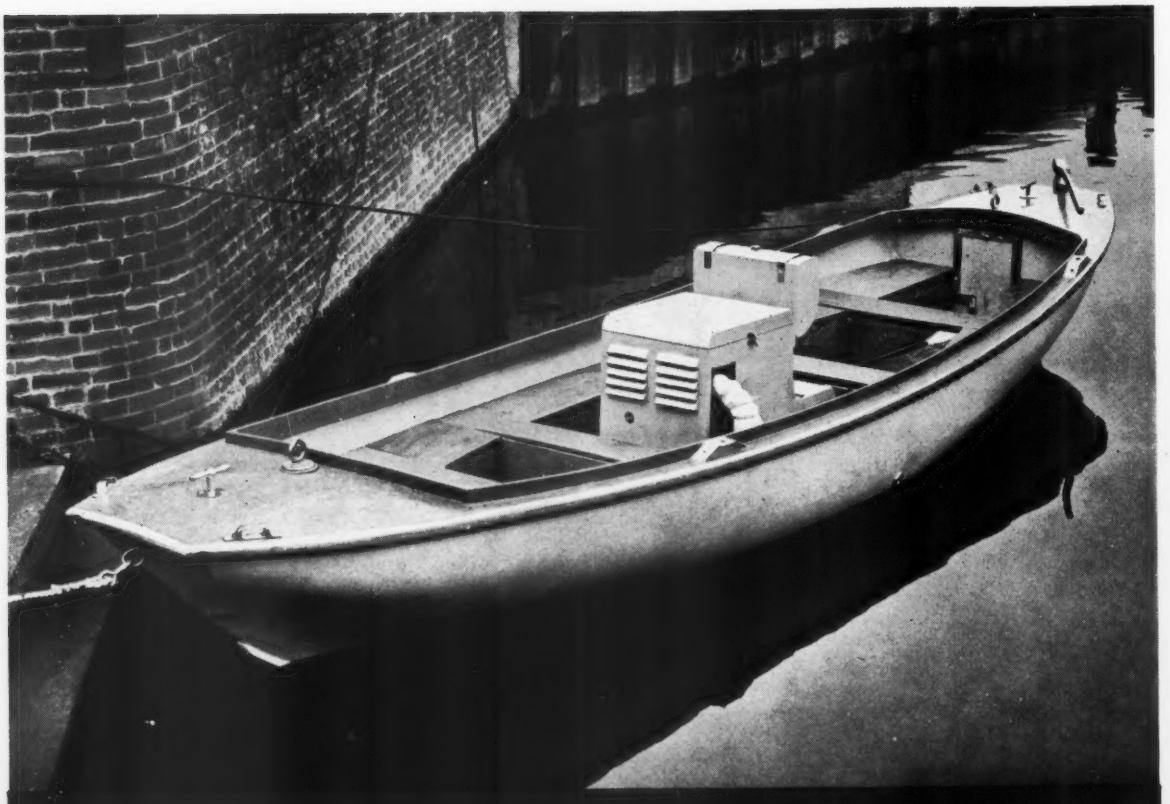

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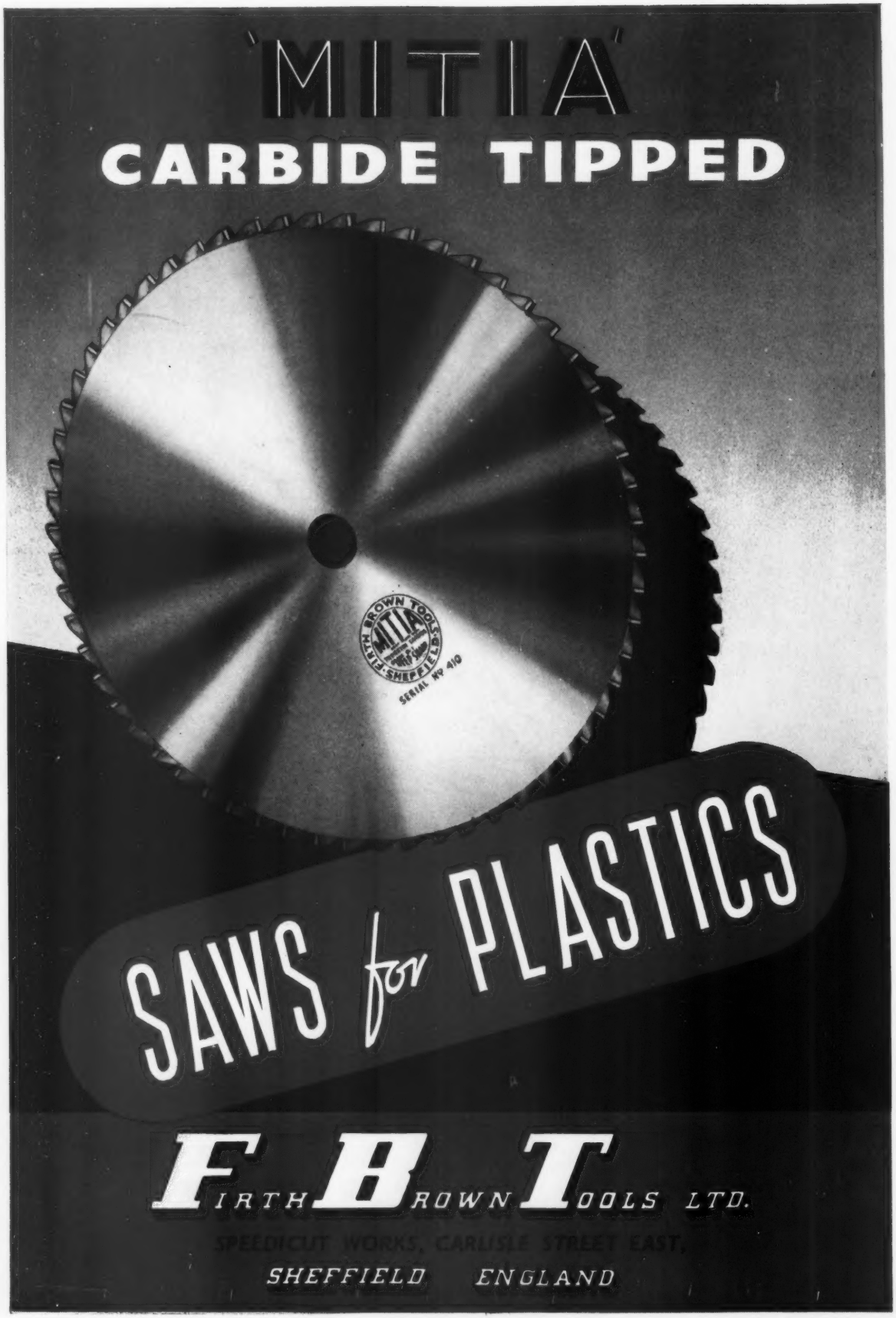
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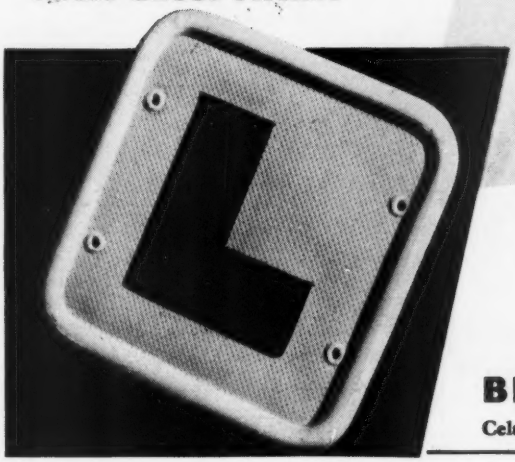

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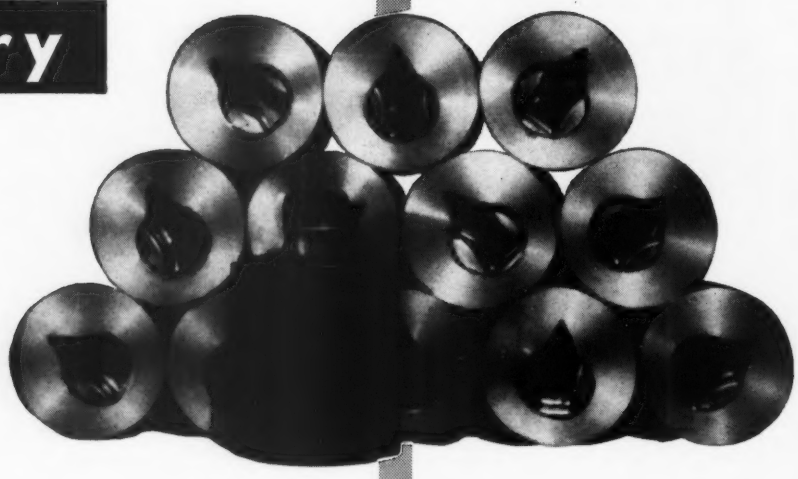
# Hob-Knobbing with the Radio industry



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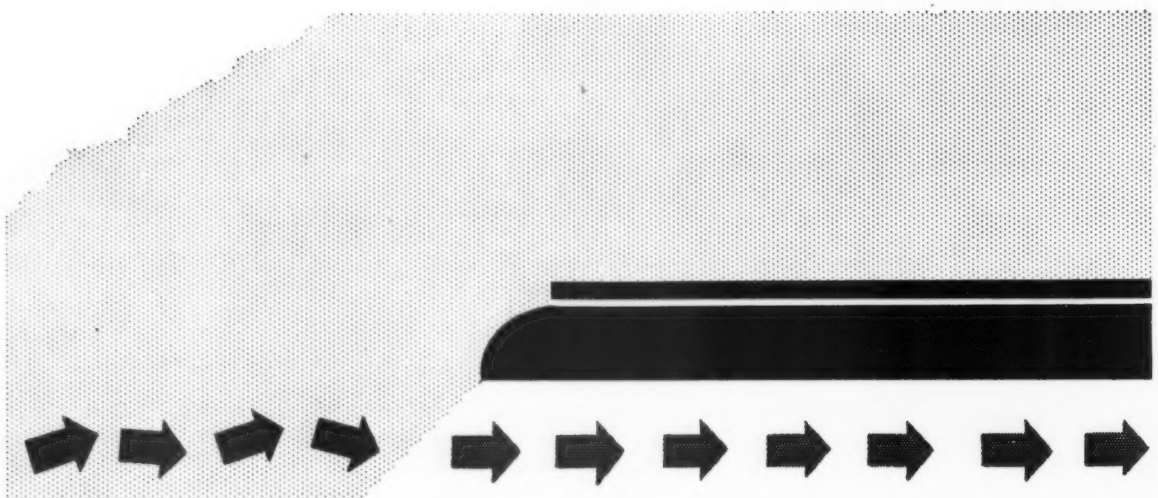

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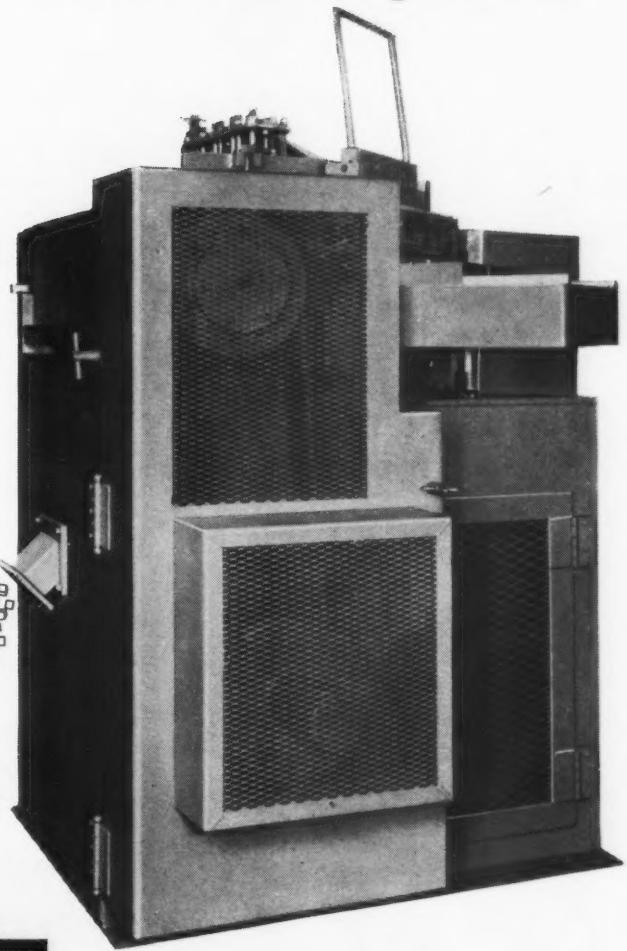

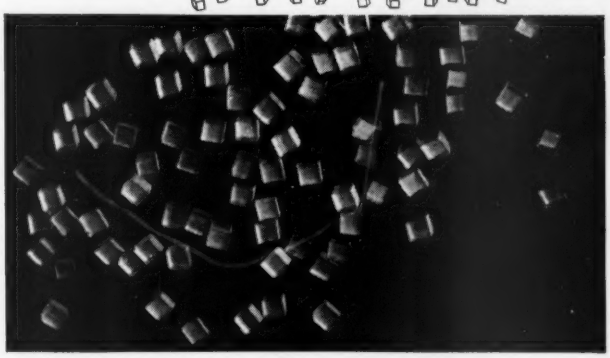

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- **Design and manufacture of special screws.**
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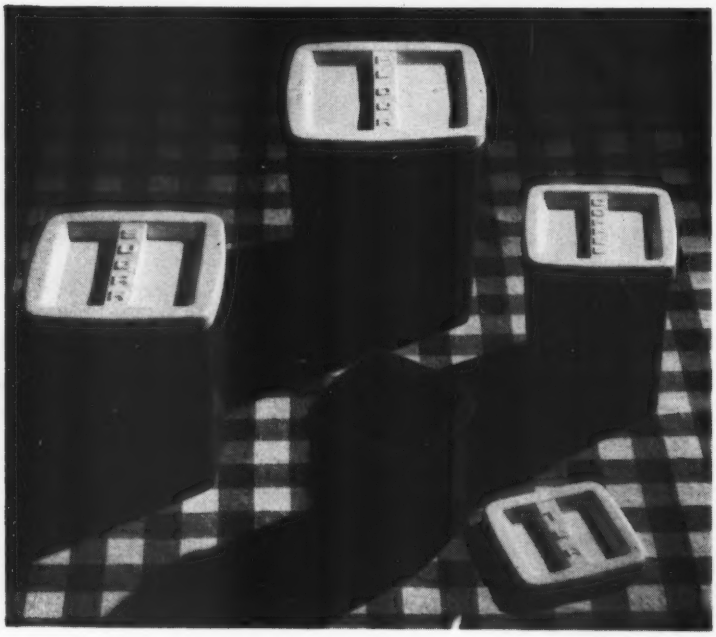

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TGA PP2

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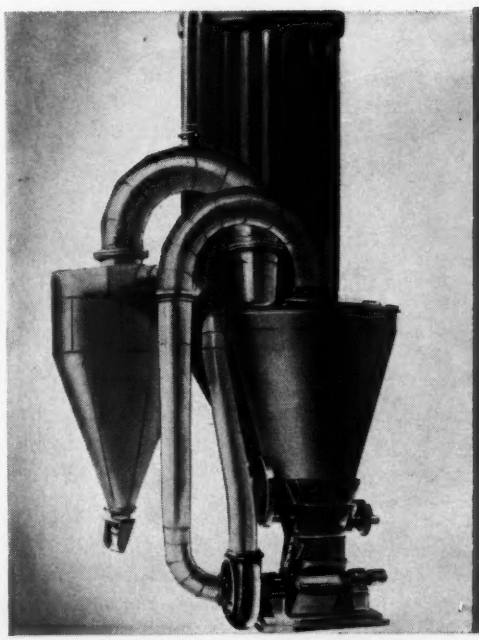

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# Plastics

DEALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS

PROPRIETORS: TEMPLE PRESS LIMITED

CHAIRMAN and MANAGING DIRECTOR: ROLAND E. DANGERFIELD


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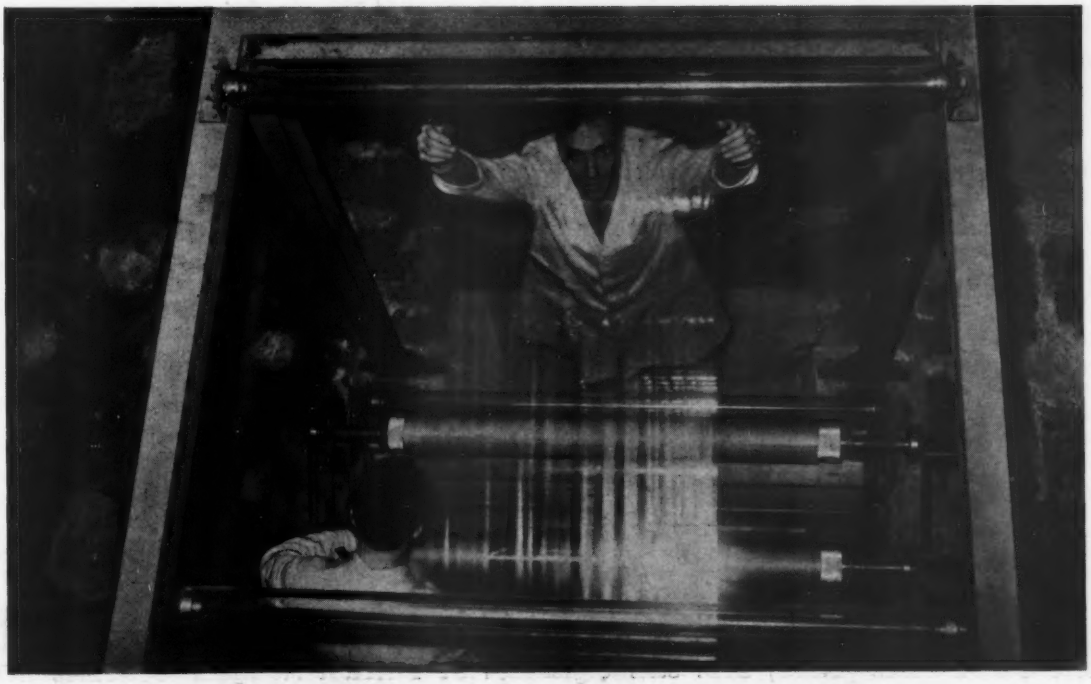

*Extrusion of clear p.v.c. film at the St. Mary Cray Factory of Greenwich Plastics, Ltd.*

NP33

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Plastics

VOL. XXI. No. 222 JANUARY, 1956

# EDITORIALS

## Radioactive Isotopes and Plastics

WE have already, in these pages, hinted at some of the exciting possibilities that have arisen from the separation of certain radioactive waste materials derived during the production of atomic energy. Sir John Cockcroft's recent paper on "The Future Role of Atomic Energy in Industry, Science and Medicine" before the British Institute of Radiology disclosed several new aspects.

We may point out that the author did not refer to the hardening of polythene by irradiation at all, and indeed this interesting occurrence, which seemed important to the plastics industry two years ago when we first reported it, now appears to be of academic interest only in view of the rigidity of the Ziegler and Phillip's polythenes and their ability to withstand operating temperatures of 125° C.

To us, the most interesting fact refers to the polymerizing action of radio-caesium and it has already been shown to be technically feasible to polymerize ethylene gas to polyethylene by this means. Furthermore, a source of radiation of 100,000 curies would enable 1,000 tons of polymer a year to be produced at a cost for radiation of about one penny per pound. This is about the same as the cost of a catalyst in existing processes.

No information is yet available regarding the characteristics of such a polythene but one point seems quite clear. Since normal metallic or oxygen-carrying catalysts are not present in the reaction at any stage and since the radiation catalyst does not stay in the polymer, "ageing" changes would tend to be fewer. This advantage appears especially in certain polymers, e.g., the blood plasma polyvinyl pyrrolidine in which the absence of contamination is highly desirable.

This important question of polymerization at once brings other questions to mind. Sir John Cockcroft mentioned also the production of polymethacrylate styrene and of fumarates using radio caesium and, of course, most readers know that polymethyl methacrylate and others have been catalyzed with ultra-violet radiation, so that with modern technical difficulties in view, we may ask: can the new polyesters used with glass fibre and other reinforcements be catalyzed by similar methods?

To put the matter in another way, would there not be an improvement if the oxygen catalyst and the cobalt accelerator were excluded? In our own mind, we believe these catalysts create the possibility of "ageing" problems which continue throughout the life of the structure and also have their effect on colour during that life. Who knows, it may also be possible to cross-polymerize without the aid of styrene.

## Vacuum Forming

AS a number of readers are aware, we are in process of gathering a series of costing figures in an attempt to find some relationship between the cost of moulding a given unit or component by the injection process and that of producing exactly the same object by vacuum forming. To put it rather crudely, the problem may be regarded as "injection moulding versus vacuum forming" or more technically, but still vaguely, as a search for the point at which it becomes economically advantageous to use the vacuum-forming process instead of the injection press or conversely, where it is economically necessary to use the injection method and not the vacuum-forming process.

The reader may well believe that it is a tall order to assess for the pitfalls are many and the number of variables seems so great, quite apart from the fact that there is not a great number of factories which work both methods and that it is in such works that a close approximation can best be made. Whatever the difficulties, few would deny that even generalities would have their value and moreover that any disclosed methods of costing such productions should prove of interest and even of importance to other moulders and to students. In any event, the collaboration of a number of technologists in the industry has already been afforded us willingly, which encourages us in the belief that the matter is of importance. We are truly grateful for such support, and hope to be in the position of collating all the data received within the next month or so.

One piece of information we have received from the U.S.A. has only a distant connection with the above problem, but will nevertheless be of interest so far as the trend of vacuum forming is concerned. In that country, where the process received an immediate welcome some time before it spread rapidly in Europe, the large number of machines employed had led to rapid development and consequent relative narrowing of prices so far as injection-moulding material and sheet are concerned. A significant change has taken place in the refrigeration industry which has widely standardized on vacuum-formed inner door panels. Moreover, as we foresaw some year or two ago, the natural corollary of installing sheet extrusion machinery adjacent to the vacuum-forming line has in fact begun. One factory has six extruders supplying six vacuum-forming machines all in constant operation, and of the dozen or more making refrigerators, most are contemplating their own extrusion-forming lines. It seems unlikely, in view of the much smaller production of refrigerators here, that such a possibility will arise here, but one never knows.

But clearly, returning to the original problem, and with the new production speeds of vacuum forming made possible by such chain methods and the lower costs of sheet to the big user by the introduction of extrusion within the factory, the problem is opened up still wider.

## Polystyrene and Polystyrene

LIKE most plastics, polystyrene has had its ups and downs in its astonishing history. The quantities made here in pre-war days were extremely small compared with those made today and most of it used was imported from Germany. Likewise, how small was the number of injection machines in existence and among the few there were more ½- and 1-oz. machines than 2-oz. machines which then seemed the largest available or desired! We were still feeling our way with the new plastic, but all realized that its superb electrical properties, resistance

to water and to sulphuric acid, its water-white transparency, ease of moulding and low cost made it clearly of the first importance to the technologist in industry or indeed to any worker who would make adequate allowance in design for its shortcomings. Indeed, it could and did, under these conditions, also take its place for demands outside the severely technical applications.

When, in the post-war years, the flow of polystyrene increased to a spate, the world was bombarded with a propaganda that presented it as a panacea for all plastic ills and which inevitably attracted many who saw in this beautiful and colourful material an ideal base with which to excite the eyes of the very young and the not so young, in the form of toys for the one and as household goods for the other. This in itself was a laudable object on the part of the promoter who would take advice from the reputable moulder, but soon the markets of the world were flooded by those who saw more profit in selling cheaper than cheap by the use of less and less plastic for a given job. Never was the word "competitive" brought into greater disrepute by these "jerry-builders" than at this time.

The very recent years have seen great changes, for the polystyrene manufacturers in their searches for high-impact polystyrenes have succeeded in producing materials of exceptional merit. This work began in the U.S.A., where great experience in the sphere of synthetic rubbers containing styrene showed the way, but production here is now well ahead also. Most manufacturers are now producing polystyrenes of improved toughness and, as described in our October issue, British Geon's new factory for producing the famous Dow Styron in this country is in full operation.

The most recent announcement in this field is that of Monsanto's which is detailed on page 14 of this issue. It is especially welcome since its development has been throughout of British origin at the Fulmer Research Laboratories of the company. All such advances are the best New Year's gifts that could be given to the industry.

# Moulding Powder and Shot

***Couldn't Happen Here!***

My good friend Mr. Charles Waghorne of Insulators, Ltd., went to the Swedish Plastics Federation meeting in Stockholm last November and tells me how efficiently the meetings had been arranged by Mr. Erik Jansen and his staff. At the official dinner, after an American visitor had spoken of the industrial situation in Europe and had gently pulled a few legs, Mr. Waghorne replied on behalf of the guests. He said that despite our own jokes against ourselves, the old country was not doing too badly and that production was still increasing. He mentioned many of the difficulties that exist here and then read out the following memorandum that had been posted up on a works' notice board: "*To all employees.* Due to increased competition and a keen desire to remain in business, we find it necessary to institute a new policy and effective immediately. We are asking that somewhere between starting and quitting time and without infringing too much on the time usually devoted to lunch period, coffee breaks, rest period, story telling, ticket selling, vacation planning and the rehashing of yesterday's T.V. programme, each employee should endeavour to find some time that can be set aside and known as 'Work Break.' To some this may seem a radical innovation, but we honestly believe the idea has great possibilities. It can conceivably be an aid to steady employment and it might also be a means of assuring regular pay checks. While the adoption of the Work Break Plan is not compulsory, it is hoped that each employee will find enough time to give the plan a fair trial." The inference was, of course, that it had been stuck up in an English factory, but when Mr. Waghorne disclosed that it had happened in Los Angeles, it really "brought the house down."

* * *

***What Nature Forgot***

Saw, last month, one of the most delightful instructional films on plastics it has been my pleasure to see—an Anglo-American effort by Monsanto, that for sheer beauty of colour and ingenuity of design of movement took my breath away. Quite non-technical in character it showed the sun and air and water creating the world as we know it, life, vegetation and minerals, and then the work of man building new units from coal and petroleum, building plastics, "The World that Nature Forgot." We saw the dance of the molecules, their collision and growth to bigger molecules and so to polymers and thence, in man-made machines, to objects of beauty and utility. It was a memorable film, and if I do not agree entirely that Nature forgot to make polymers (I seem to remember that my own liver and lights, poor things but my own, are made from pretty hefty polymeric condensates and so are rubber, kippers, natural resins, your and my winter woollies, sugar, cotton, wood, silk and Miss Universe's legs) I can also forgive the title for the sake of poetic licence—those who made the film were as near poets as dammit.

* * *

***Hic Jacet Steve Brodie***

Very many years ago when I was hopping about like a two-year-old between Mexico and Texas and points west, my friends and acquaintances seemed to be mostly U.S. citizens. I often came across the spoken expressions "He did a Steve Brodie" or "Well, Steve Brodie took a chance. . . ." I was a bit diffident about asking who the mysterious and ubiquitous Mr. Brodie was but eventually discovered that he was one of those strange individuals who jumped off Brooklyn Bridge for a bet (or perhaps it was just to show what could be done), and was drowned. What the two expressions meant were "To do something foolish or spectacular" and "I'll take a chance also"—referring to anything from a new purchase to climbing a mountain. I am reminded of this and relate it to explain the last sentence in the following verse in iambic pentameters written by Vaun Arnold and published recently in *The Kansas City Star*. The cutting was sent to me accompanied by the note: "Take heed! Remember what happened to your uncle, Lancelot (Slush) Dogsboddy! Signed, Codlin's the friend, not Short." All I can say is, it's a lie!

**Steve Brodie**

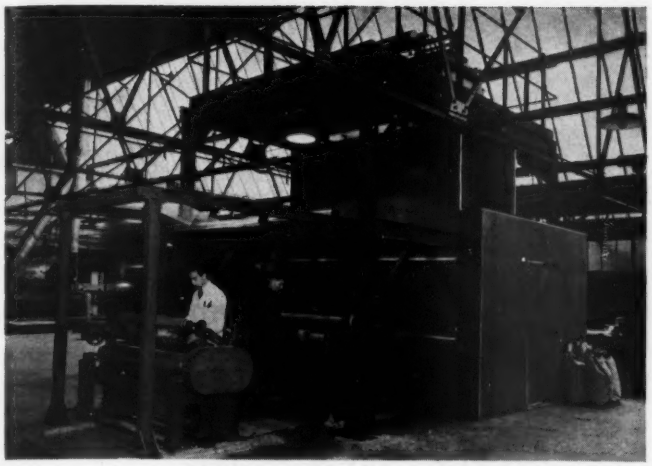
Lo, how the mediocre waxes great
By showmanship; the clinker is a star
Of brilliance, and the peanut will inflate
Amazingly, through the spectacular.
One ounce of talent with a pound of brag
Outstrips a ton of virtue standing mute;
The silent saint is lost, the scallawag
By blatancy inveigles the salute.
The heard, the seen, the antics of a midge
Incredible will dwarf the finest plan
Of engineers. Who built the Brooklyn bridge?
Who cares! Steve Brodie was the greater man.

* * *

***Happy New Year!***

Having returned safely, albeit somewhat swollen and congested, from my usual Christmas retreat to Old Ma Grigg's Respectable Guest House at Wapping Old Stairs (double helping of Xmas pud.; no visitors allowed in single gent's rooms), it is now my pleasure to wish all our readers the happiest and most prosperous of New Years. Above all, we, the Staff of *Plastics*, wish to thank so many of them for their generous help during the past year in making this journal of some use to our industry, and, what is perhaps more important, to the world at large. Good Hunting! Good Moulding!

DOGSBODDY.



# Extrusion of Clear P.V.C. Film

*The announcement of commercially available clear p.v.c. film has been one of the most interesting news items in recent months. The following notes on its production and properties have been compiled with the co-operation of Greenwich Plastics Ltd.*

THE manufacture of polythene film by the extrusion blowing technique has been reported in some detail in technical literature. The principle briefly is to make use of a circular extrusion head, out of which is extruded a tube, subsequently sealed and then inflated by means of compressed air to give the required wall thickness and diameter. Polythene lay-flat tubing has already found wide application in the packaging field and has also been used in a similar way in film form.

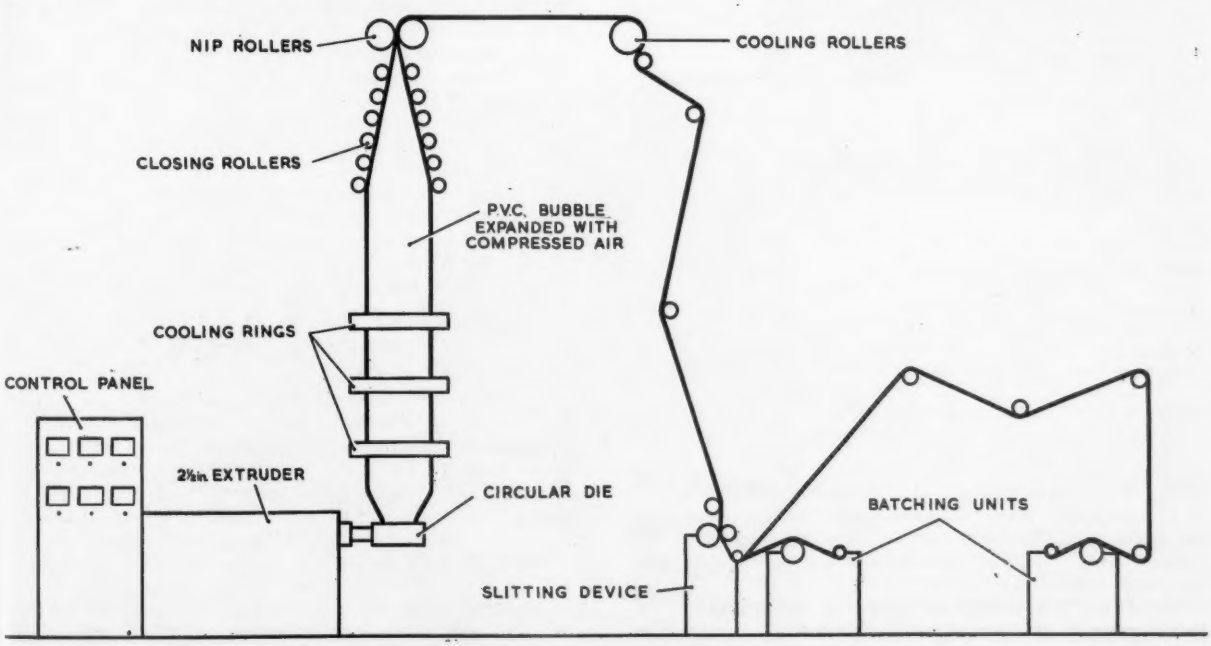
The adaptation of this process to p.v.c. offers, however, problems of a very much more serious nature, and so far as is known at the moment, only three companies in the world are in production. The difficulties encountered stem from the very much more complex and closely controlled compounding techniques that are called for prior to the extrusion process itself plus the fact that the die temperatures required to successfully extrude p.v.c. film are those at which thermal decomposition of the material is rapid. To overcome these difficulties careful attention must be paid to formulation, compounding control and die design.

We recently visited the St. Mary Cray factory of Greenwich Plastics, Ltd., where, as has been announced recently in the Press, a full-scale plant for the manufacture of p.v.c. lay-flat tubing and film up to widths of 36 in. is now undergoing proving trials. The apparatus employed is in general principle similar to that used for polythene. An extruder of American manufacture supplies the compound to a circular die head, where it is extruded vertically in tube form and blown by compressed air to the required size and thickness. The bubble passes through a series of annular cooling rings delivering small jets of air, after which it is compressed in a series of closing rollers and hence into a pair of nip rollers where it is flattened to produce lay-flat tubing. It finally passes to ground level where it is trimmed and batched.

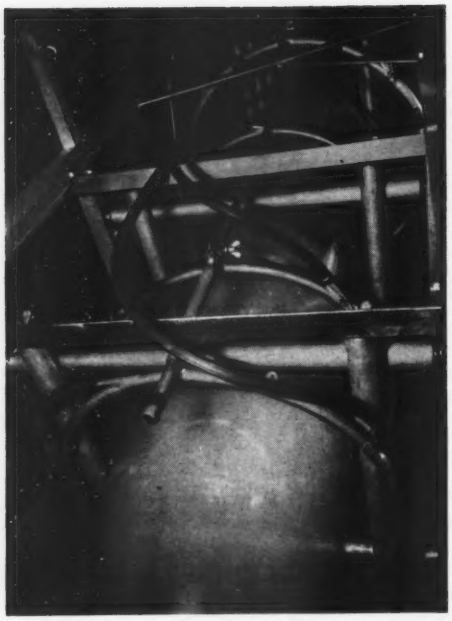
Experimental work subsequent to the delivery of the plant has absorbed several months of work and proving trials are still continuing although sample quantities of film have been distributed to the trade for field trial purposes.

### Importance of Accurate Plant Control

The outstanding feature of the film is its excellent clarity. The maintenance of this clarity despite the limited heat stability of p.v.c. at the temperatures of processing has proved




CONTINUOUS EXTRUSION OF P.V.C. FILM



(Above) The film is shown here passing out of the nip rollers at the top of the plant, and over one of the cooling rollers.
(Left) Having left the die-head, the bubble passes up through the cooling rings. At the top of the photo can be seen the closing rollers, immediately beneath the nip rollers.

to be the greatest obstacle to be overcome. At the outset it was necessary to find the optimum conditions for processing, and having found these to initiate a rigid control system to ensure that these conditions were strictly maintained.

The initial work on the project was carried out in the laboratory where technicians had to evaluate the most satisfactory raw materials available for use. The problem of finding the most satisfactory heat stabilizing system was one which presented most difficulty and literally dozens of stabilizers and stabilizer systems were investigated in the process. The final formulation was arrived at only after many plant trials.

One of the most interesting aspects of this process lies in the preparation of the compound. Both the preparation of raw materials and the subsequent compounding may be said to be critical operations. Slight errors in the weighing of ingredients will lead to variations in film quality and to subsequent readjustment of conditions for the extrusion process. Accurate weighing equipment and strict supervision of this section of the work is essential.

For the compounding process, one of the Buss Ko-Kneader machines is employed. This machine is regarded as the most effective for compounding the polymer with plasticizers, stabilizers and lubricants. Particular care is necessary at this stage in order to produce a well dispersed and adequately gelled compound. Strict control of temperatures must be maintained to effect good compounding. Bad compounding will undoubtedly result in bad film making.

### Properties of Extruded P.V.C. Film

| | |
|---|---|
| Specific Gravity ... ... ... | 1.26 |
| Tensile Strength (B.S. 1763) ... | 4,500 lb. per sq. in. |
| Tear Strength (B.S. 1763) ... ... | 450 lb. per in. thickness |
| Elongation at break ... ... | 200 per cent. |
| Dimensional Stability ... ... | 3 per cent. |
| Maximum Working Temperature | 70° C. |
| Water Absorption ... ... ... | Less than 1 per cent. |
| Water vapour permeability of film gauge .0025 in. at 25° C. and 75% relative humidity ... ... | 7 gm. per sq. m. per 24 hr. |
| Water vapour permeability of film gauge .0025 in. at 38° C. and 90% relative humidity ... ... | 29 gm. per sq. m. per 24 hr. |
| Colour ... ... ... ... | Crystal clear. |
| Ageing and Light Ageing ... ... | Good. |
| Chemical Resistance ... ... | Excellent. |
| Blocking ... ... ... ... | Very slight. |
| Weldability ... ... ... | High-frequency or heat. |
| Limits of Thickness ... ... | .0025 in., .002 in., .0015 in., .001 in. |
| Limits of Widths ... ... ... | 36 in., 30 in. and 24 in. sheeting and lay-flat tubing. |
| Yield ... ... ... ... | .001 in.—150 sq. ft. per lb. approximately. |
| | .0015—100 ,, |
| | .002—75 ,, |
| | .0025—60 ,, |

### Evaluation of Processing Conditions

With regard to the extrusion process itself the problem of control and the evaluation of ideal conditions was one which required many months of trials. The heat input to the extruder is supplied by six heating zones on the barrel each under independent control, and on the die-head by three heater bands. The distribution of heat along the barrel to the head has been found to be critical. Screw cooling has also had to be put under accurate control. The most exacting feature of the process has been the control of flow conditions on the die-head itself. Any tendency for the flow of material in the head to be retarded results in material sticking to the side-wall of the head and consequently to rapid decomposition. It may well be said that the efficiency of the process is as good as the flow of material through the head. A diagrammatic flow-sheet for the process is shown at the bottom of the first page of this article.

### Uniformity of Film Gauge

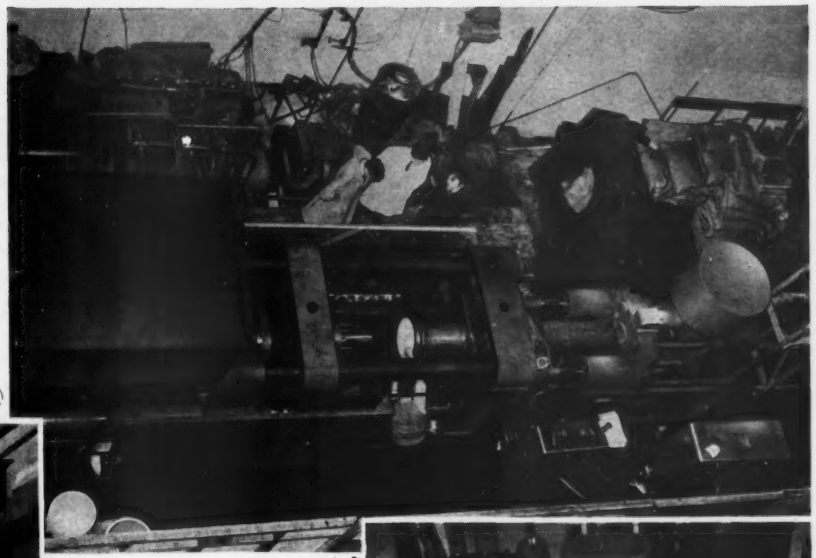
Films of .001 in. to .0025 in. are being produced and the control of these gauges is another important aspect of the process and this is achieved by the combination of a number of factors including die-setting, uniform flow in the head and bubble cooling. The last of these factors has also considerable effect on the bubble shape. Uneven cooling of the film results in bubble distortion and consequently severe creasing in the nip rollers. The control of gauge and bubble shape has a critical effect on the final batching of the film.

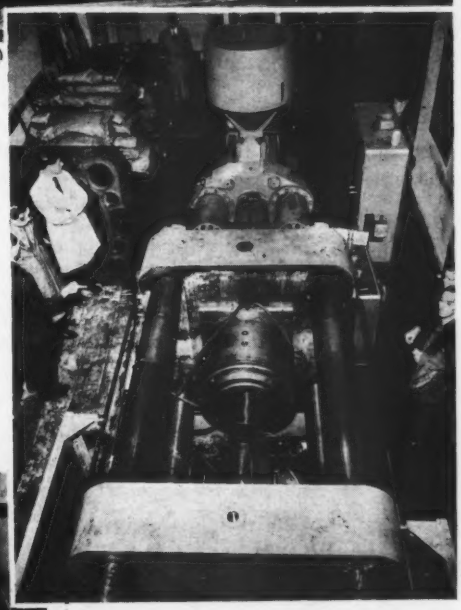
When full-scale production is commenced, a product will be available which, on the strength of its inherent properties, will find wide application in numerous ways, especially in the packaging field.

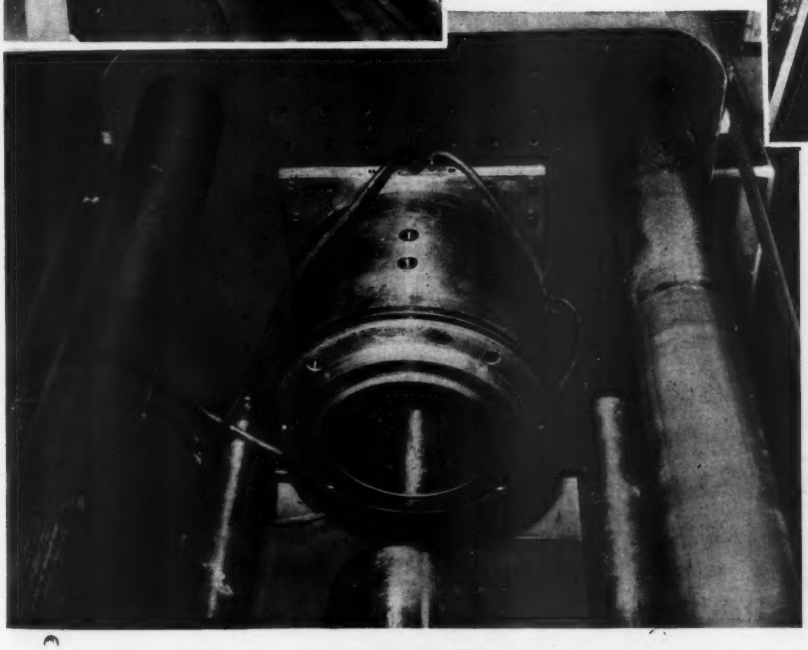
# Proving Trials of 160-oz. Injection Machine

THE announcement by The Projectile and Engineering Co., Ltd., that the first British-built 160-oz. capacity injection-moulding machine had been completed came in November last, and was the subject of an article in the issue of *Plastics* for that month (pages 386 and 387). The machine has been purchased by Halex, a division of the British Xylonite Co., Ltd., and we recently spent a day at the Battersea works of Peco where the machine is undergoing proving trials by Halex technical staff. On this occasion it was at the commencement of its first 24 hours' run, and, working through the night, used two tons of polythene.

Both the specification and details of capacity for this machine have already appeared in *Plastics*, but one of the most impressive features in operation is the short-cycle time maintained. For example, when moulding a large household bin, the press was cycled at three minutes, on a 92-oz. shot. This is largely due to the pre-plasticizer arrangements whereby the polythene is heated in a separate chamber before being transferred to the injection cylinder.







(Above) A view from the workshop crane; a moulding can be seen being removed from the die.

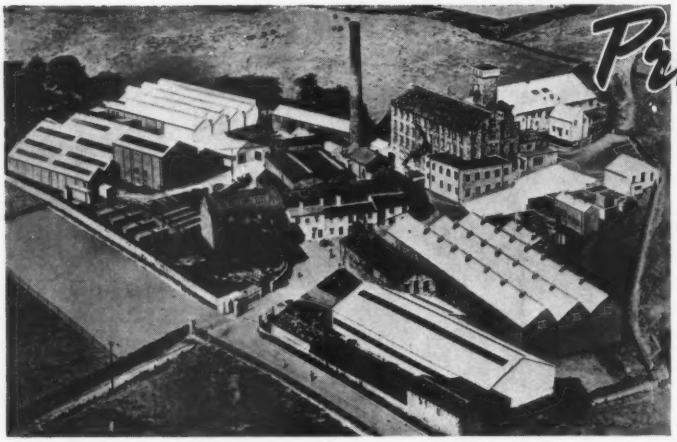
(Left) One of the household bins—note short sprue.

(Right) An end-on view, showing die open.

(Below) Close-up of punch and die, showing simplicity of construction.

Halex are very optimistic about this press, the largest to be built outside the U.S.A. We understand that the first two jobs it will undertake are the bin referred to above, 16½ in. diameter and 23¼ in. deep, and a general-purpose tub, of special interest in many industrial applications, 24½ in. diameter and 10 in. deep.

The photographs on this page were taken at Battersea during the proving trials. The "aerial" view from the workshop gantry crane gives some indication of the size of the machine.



# Production Story

*A feature of this series has been that each article has highlighted a specific moulding, taking the reader through all its stages of manufacture. In the latest "Production Story," we are concerned with a company of a special kind, in that Birkbys Ltd. not only operate a large moulding organization, with ancillary services, but also make by far the larger quantity of powder which they mould. In a sense, therefore, this is a truly complete production story, embracing every phase of material, tool and moulding procedure, and serves also to illustrate the development of one of our oldest plastics companies.*

THE history of thermoset moulding has its beginnings with the first world war, and very few of the famous companies in the industry today can look back upon a record of 40 years of continuous service and development. It was during that era that the founders, A. T. and F. E. Birkby, members of a family well known in the world of textiles and textile equipment, commenced to develop and manufacture thermosetting resins, moulding powders and mouldings, under the trade name "Elo." Through foresight, to be admired in view of the difficulties the industry was later to undergo, they saw the potentialities inherent in these materials, and it was the policy laid down in those very early days that was responsible for the later and very successful expansion of the company.

The Birkby brothers held that so far as it was humanly possible, they should be self-supporting, in that they would design, draw, and make every moulding tool themselves, together with all resins and moulding materials. At each stage of manufacture, the process would be in the complete control of the company. This policy has remained unchanged, and today is just as forcefully maintained as in the beginning. Of the phenolic moulding materials and moulds used in the moulding shops 98% are made by the company, which makes it almost unique in the plastics industry of Great Britain.

The advantages of this arrangement are obvious. Designers and draughtsmen can follow each new tool through until it is established in the production shops, and if teething troubles are encountered, these can be quickly ironed out; where real difficulties arise, the designer, draughtsman, toolmaker and moulder can quickly get together for whatever action may be necessary. If adjustment of the moulding compound is called for, the powder department is readily at hand for consultation.

With this introduction to the policy and structure of Birkbys, we come now to the inter-relationship of the various departments of the company, and their influence upon an interesting series of mouldings manufactured for the Automatic Telephone and Electric Co., Ltd., Liverpool. Both to the customer of the plastics industry, and to the moulder, the story of these components is of interest, since not only does it reveal the true function of the moulder, but it also serves to show the continuity of service offered by the moulder to his clients.

### Electrical Mouldings

In 1938 the Automatic Telephone and Electric Co. placed an inquiry for mouldings to be used in their "Rythmatic" ripple control centralized remote switching systems. Use of this system enables impulses of different frequencies to be sent to various control points, and enables, for example, the street lighting of a town to be turned on in sections, avoiding the overloading of the electricity supply. The system is also

Fig. 1. (Left) "Rythmatic" control. Fig. 2. (Above) Case, base and mounting unit moulded by Birkbys. Panel mouldings for the control unit.

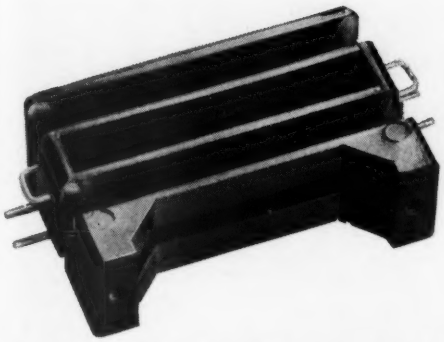


Fig. 3. Double spool moulding for the Automatic Telephone and Electric Co.

employed in industrial and domestic electricity supplies, thus enabling emergency conditions to be met without the risk of a general breakdown.

The requirement was a set of mouldings comprising case and base, mounting panel, and double spool. The complete unit is shown in Fig. 1, and the component mouldings in Figs. 2 and 3.

The designers decided to put the case and base moulds side by side in a 150-ton semi-automatic press. The panel mould was designed for a 28-ton semi-automatic press. The double spool, in view of the complicated core plug requirements, plus the anticipated difficulty in controlling the correct positioning of the small wire contact at each end of the mould, was originally designed for hand press operation.

The quotation was accepted and work was started immediately on the tools. A view of the drawing office is shown in Fig. 4. Probably none of the people who were associated with the original tool drawing 17 years ago thought that these tools would be still in use in 1955.

Fig. 4. The drawing office.

### Tool Manufacture

Manufacture of the tools was carried out, in common with the usual Birkby practice, in the company's own toolroom, re-built in 1935 and doubled in size in 1947. As will be seen from Fig. 5, the toolroom is not only well suited from the point of size to serve the demands of a large moulding organization, but it is also extremely well equipped.

In the course of the manufacture of these tools and in their trial runs, many troubles had to be faced and overcome. Airlock and distortion were met with on the case and base moulds and it was impossible to obtain flatness and freedom from distortion until an elaborate venting system had been devised and put into operation.

It was also found that under the somewhat exacting conditions in which this switch worked, standard moulding materials were definitely unsuitable and therefore the laboratory and powder department were called in and a special grade of material was produced. This ability to modify materials on the site is one that stands the company in good stead; part of the resin manufacturing capacity of the organization may be seen in Fig. 6, and this is linked with a powder manufacturing department of corresponding size.

Except where a customer expresses a wish that one of the special purpose phenolic materials marketed by proprietary manufacturers should be used, the entire phenolic moulding powder consumption of the company is met by the powder department, amounting, as already noted, to over 98% of the total. Where an order for mouldings calls for the use of materials other than phenolics these materials are, of course, purchased from manufacturers who specialize in the particular type or grade required.

In line with Birkbys' policy, all the moulds were made of nickel chromed steel, case hardened, and designed to last as long as the mouldings are required. The other moulds, apart from the double spool, where a completely new design was introduced at a later date, are still in production and show few signs of wear. The general assembly for the latter moulding can be seen in Fig. 7 where the operator is removing a finished moulding. In Fig. 8 is shown the cover and base moulds in position. Ancillary to the work of moulding

Fig. 5. Toolroom facilities.

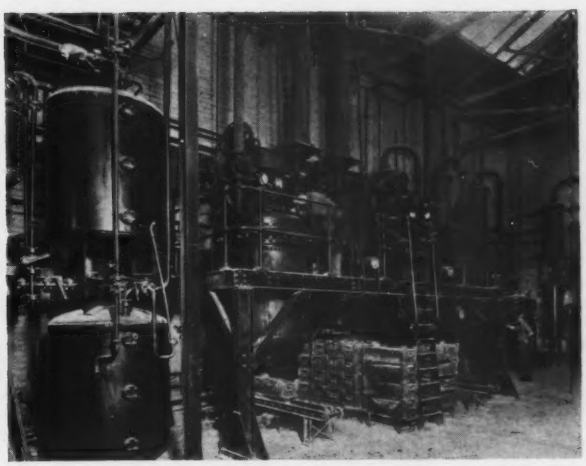
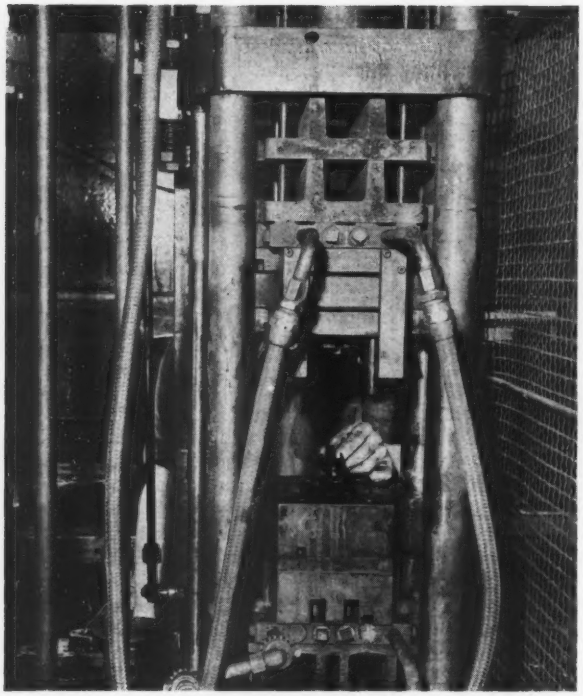


Fig. 6. A section of the resin-making plant.



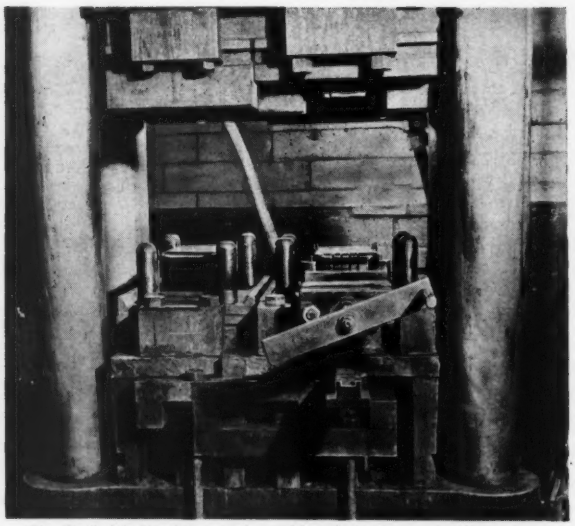


Fig. 7. (Left) Double spool moulding being removed from press.
Fig. 8. (Above) Tools for cover and base in position.

departments, located both at Liversedge and Wythenshawe are the finishing and inspection departments; Fig. 9 gives some idea of the size of the Wythenshawe section of the organization and this should be related to Fig. 10 showing the finishing department of the same plant. The mouldings with which we are concerned undergo several finishing operations, and these include flash removal on the double-spool component and drilling on the cover.

In the inspection department, a general view of which is given in Fig. 11, special care is taken to ensure that the mouldings not only meet the overall high requirements of the company but they are also electrically perfect, and in Fig. 13 is seen a member of the inspection department testing the circuit of one of the double spool mouldings.

The demand for these mouldings has been gradually increased since the war, and Birkbys have stepped up productive capacity quickly to more than four times the original potential by the introduction of improved moulding techniques and pre-heating arrangements and the production of a further set of tools. The simple hand mould originally laid down for the double spool has been superseded by the

Fig. 9. This photo shows part of the moulding plant at Wythenshawe.

Fig. 10. The main finishing shop serving the Wythenshawe section of the company.

Fig. 11. The inspection department at Liversedge.

Fig. 12. Cover moulding being jig-drilled.

Fig. 13. Circuit testing the double spool moulding.

faster-producing semi-automatic tools designed not only to increase production but also to eliminate most of the finishing operations that were necessary with the original mouldings.

The foregoing notes show briefly the relationship that must exist in any organization between all of the relevant departments in the production of the highest quality mouldings. However, the advantage of having moulding powder manufacture under the control of the moulder is perhaps even more clearly shown in the instance of the Murphy radio cabinets. Murphy Radio Ltd., for whom Birkbys make several different styles of phenolic radio cabinets, require these in different ranges of colours, in shades of brown, and a deep plum colour. This presents the moulder with a far more difficult problem than would at first seem the case. It is one thing to mould a large cabinet when the intention is to have a mottled surface or even to use a coloured spray finish, but quite another when the actual moulded finish has to be free from flow marks, two-colour effects, resin separation and other blemishes which can mar large plain surfaces. To meet the exacting demands of the Murphy radio company, the closest co-operation was called for between the drawing office, toolroom, powder department and moulding department. The tools were modified in stages, and the powder department produced after many weeks of trial and error, coloured phenolic moulding powders which gave the necessary degree of uniform blemish-free surface. The finished results can be seen in Fig. 14.

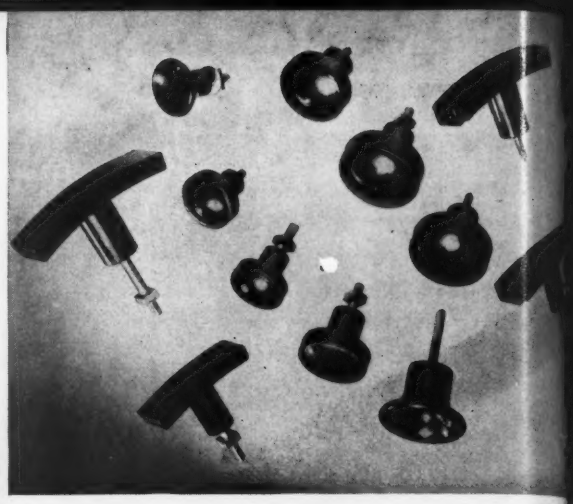
Fig. 14. Murphy radio cabinets.

# PLASTICS
## IN THE SERVICE OF MAN

*A pictorial review of high-quality units moulded or otherwise fabricated in Great Britain . . .*

### 63. Furniture

**A list of trade-marks and companies mentioned in this review, with full names and addresses, appears on page 23**



(Above) Cabinet fittings moulded by Runcolite Ltd., and designed by Gaby Schreiber.

(Left) Kitchen table made by Beatall Furniture Ltd., with a Warerite top.

(Below) Cantilever bedside table made by Staples and Co., with Vietum, p.v.c. sleeving covered legs.

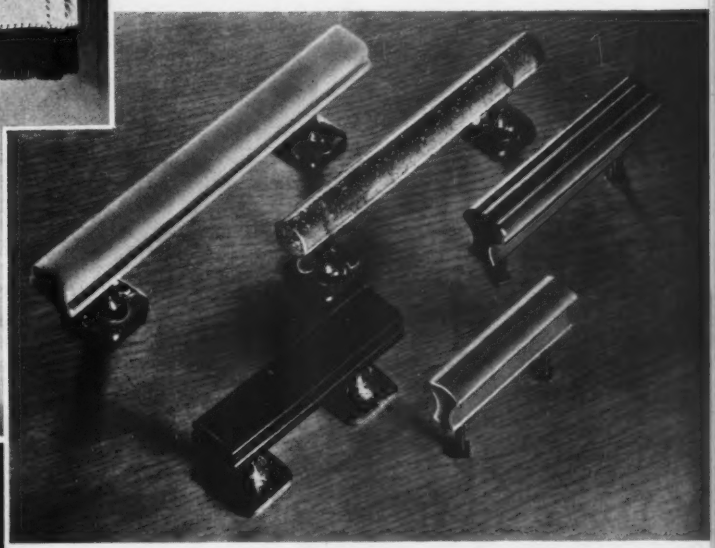
(Above) A kitchen table with Formica top.

(Left) Mahogany veneered bookcase made by Compactom Ltd., incorporating Holoplast structural units.

(Above) Armchair upholstered in Tygan woven fabric.

(Above) Chair seat and back rest manufactured by Thermo-Plastics Ltd., from fabric/phenolic laminate.

(Right) Attractive Bexoid lampshades for standard and table lamps.



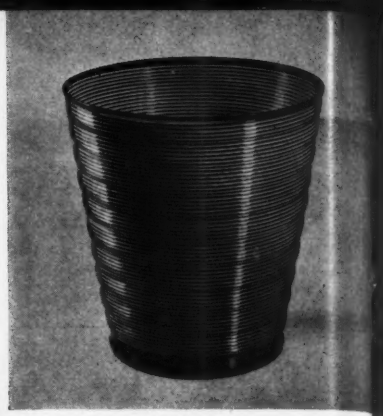
(Above) Furniture handles manufactured from cast phenolic resin by Lacrinoid Products Ltd.

(Above) A selection of furniture handles manufactured from Lactoid casein.

(Below) Polyurethane foam material cut for use as armrest upholstery by Kay Brothers Ltd.

(Below) Bedroom suite incorporating Warerite panels designed and built by Goodearl Brothers Ltd.

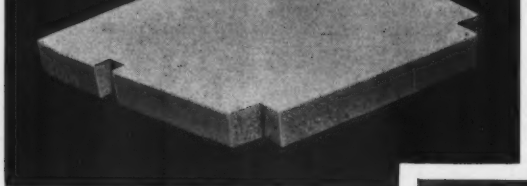
(Left) Tubular framed chair covered in Tygan woven fabric.



(Above) Waste paper basket manufactured from cellulose acetate extrusions by Rotaflex Ltd. (*Plastics*, 1955/Apr./102).

(Below) Standard lampshade made from Crinothene polythene by Godfrey Lampshades.

(Above) Triangular coffee table made by Goodearl Brothers with Formica top.



(Above) Lightweight table formed by Thermo-Plastics Ltd. from Bakelite resin laminates.

(Above) Chair seat in foamed polyurethane made by Kay Brothers Ltd.

(Right) Furniture handles moulded in urea by Lacrinoid Products Ltd.

# World's Industry Employs Plastics

## MATERIALS and TESTING

**Frictional characteristics of plastics.**—Investigation of 17 plastics under different loads, speeds and lubrication. Teflon and filled Teflons had exceptionally low, and nearly equivalent, coefficients of friction. Some filled Teflons performed as well with water as with oil. Polystyrene had dry friction figure at high speeds equal to Teflon, polyethylene with oil lubrication was also similar to Teflon.
(*Lubrication Engineering*, 1955/Sept.-Oct./313.)

**Synthetic calcium silicates.**—Produced by a one-stage hydrothermal process. They have a most remarkable high absorption figure, up to twice their own weight, extra-fine particle size and low specific gravity. Material is still in its development state.
(*Design News*, 1955/Nov. 1/9.)

**A new Polyethylene.**—Properties, processing and applications of the new low-pressure-type polyethylene (Hostalen) are described. Detailed information is presented on physical, mechanical and electrical properties and on chemical resistance.
(*Kunststoffe*, 1955/Oct./409.)

**Plastics.**—K. Allemann gives a general survey of modern plastics dealing with chemical, mechanical and economic aspects.
(*Techn. Rundschau*, 1955/Oct. 7/1.)

**Effects of static electricity.**—H. Haase reviews the present state of knowledge and techniques in this field which have an increasing influence on the manufacture and processing of plastics and artificial fibres.
(*Kunststoffe*, 1955/Oct./414.)

**Polyamide mouldings.**—Tests indicate that homogeneous spherolithic or fine-grained structures can be obtained by selecting suitable conditions. Results are important for practical application.
(*Kunststoffe*, 1955/Oct./410.)

**Butyl polymer compounding.**—Butyl compounds properly mixed and processed have the lowest water absorption of any vulcanizable polymers. E. W. Schwartz gives detailed data on compounding.
(*Wire and Wire Products*, 1955/Sep./1013).

**Plastics Institute at Aachen.**—K. Krekeler gives a review of the development and work of the Institute at the Technische Hochschule Aachen, which has now been in existence five years.
(*Industrie-Anzeiger*, 1955/Nov. 8/1335.)

**Colouring of plastics.**—P. Bernhard gives a survey of methods used to change the colour of plastics. He distinguishes: (a) dying the mass, (b) changing the surface colour, (c) lacquering and printing. He deals in particular with methods (a) and (b).
(*Techn. Rundschau*, 1955/Nov. 18/27.)

**Tensile and tear properties of plastics films.**—An investigation inaugurated by the American Society of the Plastics Industry showed that tensile strength and tear resistance (A.S.T.M. and Elmendorf) test three different properties and cannot be used in place of each other. Some revisions of existing standard methods are suggested.
(*A.S.T.M. Bulletin*, 1955/Oct./50.)

**Chemistry of plastics.**—R. C. Chirnside gives a review of recent developments in new raw materials and their applications.
(*GEC Journal*, 1955/July/172.)

**Surface treatment of and with plastics.**—P. Bernhard gives a survey of the various methods for metallizing plastics and spraying plastics on to metal components.
(*Techn. Rundschau*, 1955/Oct. 7/9.)

## INDUSTRIAL APPLICATIONS

**Plastics-faced dies.**—Hints on how to fabricate plastics-faced dies are given by W. A. Hockett. Epoxy plastics are used in drop-hammer dies. Drawing dies are either rigid aluminium-filled Kirksite dies or resilient unfilled plastics for lead punches. These dies are used with an amine synthetic liquid resin.
(*Tool Engineer*, 1955/Nov./87.)

**Epoxy tools reduce production cost.**—Construction time and costs of American jet fighters have been considerably reduced. Tools for interchangeable parts are being built from epoxy plastics.
(*Design News*, 1955/Nov. 1/14.)

**Mechanite moulds.**—Costs for producing compression moulds for thermosetting plastics have been reduced considerably by using Mechanite, thus lots of 60 to 2,100 parts have become feasible.
(*Tool Engineer*, 1955/Nov./105.)

**Plastics tooling for car bodies.**—Description of methods in works of Nuffield Metal Products, Ltd. Plastics are also used in assembly fixtures for locating panels during welding operations.
(*Machinery* (*Lond.*), 1955/Oct. 7/853.)

**Epoxy resin tools for presses and drop hammers.**—Experiences at Convair works with punches and dies faces with a layer of epoxy resin or made from this resin throughout. A number of practical examples given.
(*Machinery* (*Lond.*), 1955/Oct. 14/912.)

**Casting plastics.**—A film "Tooling for Plastics with Hydrocal," shows the results of more than 15 years' experience in casting plastics match plates, patterns and dies.
(*Tool Engineer*, 1955/Nov./197.)

**Vinyl insulation of electrical cables.**—Initial development difficulties have now been overcome. As long as present quality levels are maintained the automatic wiring field for vinyl plastics will further improve. Today a performance is obtained which could hardly be expected a few years ago.
(*Wire and Wire Products*, 1955/Nov./1368.)

**Cast resins and their applications.**—P. Bernhard surveys the modern cast resins for producing dies and parts of chemical apparatus. He also refers to centrifugal casting of tubes.
(*Techn. Rundschau*, 1955/Nov. 4/25.)

**Plastics bonding for metals.**—Based on lectures at Battersea Polytechnic the general principles and outstanding examples in plastics bonding are described by R. A. Johnson.
(*Metal-Industry*, 1955/Nov. 25/443.)

**Laminated plastics blades** maintain sealing action with reduced friction by a floating system in new automobile engine supercharger. Device requires no gears and is effective at all engine speeds.
(*Design News*, 1955/Nov. 1/36.)

**Protecting hoods for innersocket screws** have been made of polyethylene. These can be used usefully on stationary parts to prevent the ingress of dirt, as well as on rotary parts. Even on high-speed rotating parts satisfactory holding power of the hoods is obtained.
(*Industrie-Anzeiger*, 1955/Nov. 8/1338.)

**Assembly of spring-loaded electrical contacts** has been effected by epoxy resin casting. Conventional plastics moulding procedures which required pressure had to be ruled out owing to the sensitivity of the components.
(*Design News*, 1955/Nov. 1/41.)

## MISCELLANEOUS USES

**Plastics - coated bags.**—Shown at ANUGA Exhibition held at Cologne the Zupack bag is made up from a tubular pre-printed web of paper coated with polyvinylidene chloride. The bag is expected to find many applications in the self-service stores because of its ease of sealing.
(*Packaging*, 1955/Nov./41.)

**Cellulose-film twist mesh bags.**—Made from offcuts of cellulose film the strips are twisted in continuous lengths. They are then knotted to form a mesh bag. The bags are inexpensive to make and have a pleasant appearance.
(*Packaging*, 1955/Nov./38.)

**All-Nylon fasteners.**—Review of development and applications of Nylon fasteners in American industry.
(*Fasteners*, 1955-Nov. 4/8.)

**Plastics in medical science.**—O. I. van Bochove of Plastics Institute TNO gives a survey of the manifold uses of plastics in surgery.
(*TNO-Nieuws*, 1955/Oct./425.)

# A New Toughened Polystyrene

MEMBERS of the technical Press visited Fulmer Hall, Berkshire, the research establishment of Monsanto Plastics Ltd., on December 21, to see demonstrated a new toughened polystyrene moulding powder, Lustrex T-11. Fulmer Hall is now well established with excellent laboratory facilities for research into Monsanto plastics materials and is of particular interest to the moulder since a definite bias is maintained there towards applications research. To a large extent, the development of the new Lustrex T-11 has been due to the very close liaison between the technologists at Fulmer and the company's customers, with the result that the new moulding powder incorporates many features long sought after by the moulding industry.

**Properties of Lustrex T-11 Compared with General-purpose Lustrex**

| Property | Units | Test method | Lustrex T-11 | General-purpose Lustrex |
|---|---|---|---|---|
| Tensile strength .. | lb./in.² | ASTM D.638—52T* | 3,500—4,500 | 5,800—6,700 |
| Elongation at break.. | % | ASTM D.638—52T* | 20—40 | 1.5—1.8 |
| Modulus of elasticity in tension .. .. | lb./in.² | ASTM D.638—52T* | $2.5—3.5\times10^5$ | $4.0—5.0\times10^5$ |
| Flexural strength .. | lb./in.² | ASTM D.790—49T* | 6,500—8,000 at yield | 10,000—12,000 |
| Deflection .. .. | ins. | ASTM D.790—49T* | No failure (3" span) | 0.25—0.34 (4" span) |
| Izod impact strength: | | | | |
| ½"×½" bar | ft.lb./in. of notch | ASTM D.256—47T* | 2.2—3.2 | 0.5—0.7 |
| ½"×½" bar | | ASTM D.256—47T* | 1.5—2.0 | 0.4—0.6 |
| ½"×½" bar | | B.S.1493 .. .. | 0.8—1.2 | 0.3—0.4 |
| Softening point .. | °C. | B.S.1493 .. .. | 84—88 | 90—95 |
| Specific gravity .. | | | 1.05 | 1.05—1.06 |

All tests were conducted at 23°C. and 50% relative humidity. Tests marked thus (*) were conducted on injection-moulded test specimens made under the following conditions:—

Cylinder temperature .. .. 200°C.
Injection pressure .. .. .. 10,000 p.s.i. for general-purpose Lustrex. 8,000 p.s.i. for Lustrex T-11.
Mould temperature .. .. 50°C.
Cycle .. .. .. .. 30—15—15 seconds.

The following characteristics have been incorporated: outstanding toughness, rigidity, high resistance to breakage, good gloss, ease of moulding by standard injection moulding techniques and availability in whites or brilliant colours. In particular, special emphasis has been placed on extra toughness combined with adequate rigidity, a combination of properties very desirable in many moulding applications. The table given here enables a comparison to be made between the new toughened composition and general purpose Lustrex.

In addition to possessing the superior mechanical properties referred to above, the material has excellent mouldability, temperatures and pressures being generally lower than those required for general purpose polystyrenes. Moulding equipment used is exactly the same as that called for with the general purpose materials.

On account of its low moisture absorption Lustrex T-11 does not require pre-drying unless stored in a damp place. Pre-drying will, however, permit the use of shorter moulding cycles if desired.

As a freer flowing material than the general purpose polystyrenes, machine wear is much reduced with commensurate lower injection pressures.

Whilst lower cycle temperatures are possible than for general purpose polystyrenes, better products are generally obtained with T-11 by working with normal temperatures but reduced pressures to prevent flashing. For example, temperatures may range from 180 to 250° C., but may sometimes reach 300° C. The stability of Lustrex T-11 towards temperature is ample in normal use although on exposure to high temperatures for long periods it is liable to degradation. It is suggested that if the machine has to stand idle for any length of time the cycle temperature should be reduced.

T-11 scrap may be ground and re-moulded provided that the cutter knives are kept sufficiently sharp to cut the tougher material.

As with all toughened polystyrenes, best results can be obtained by using a mould temperature of 60° to 70°C.

Small gates are preferred, it being desirable to avoid wide shallow gates. A feature of the material is that it will permit of being worked in moulds which, due to lack of taper, or the presence of slight undercuts, would be unsuitable with general purpose polystyrenes.

# LETTERS TO THE EDITOR

### Signatures to Letters

SIR,—I would like to make an appeal to your European readers on behalf of American businessmen. It concerns the form used in business correspondence originating with European firms.

It has come to our attention, in receiving correspondence from Europeans, that it is not standard practice to type the writer's name beneath his signature as is customary here in the United States. I feel certain that I speak for many American businessmen in citing the difficulty encountered in deciphering illegibly-written signatures. It is impossible, as a result of this practice, to reply directly to the writer as one cannot decide upon his correct name. The few extra seconds required to type out the writer's name beneath his signature would more than pay for itself in more prompt responses and more direct routeing of correspondence.

It would be appreciated if you would print this letter so as to bring this to the attention of your European readers.

PHIL T. PAFFORD,
Market Analyst.
Modern Plastics Research Corp.,
575 Madison Avenue,
New York, 22.

### Moulding Inquiry

SIR,—We are interested in finding a firm who would manufacture on our behalf a new patented ashtray.

The ashtray consists of two halves screwed together made of a plastic material in a range of colours which forms the bowl of the ashtray. Fitted to the ashtray are three metal troughs in which cigarettes can be held. These troughs are designed to keep the cigarette from falling off the ashtray, prevent smouldering and waste of the cigarette, and rule out the risk of fire.

The plastic material used must be cheap, available in a range of colours and non-inflammable.

We require the ashtray completely assembled, made in a suitable plastic material with chrome-plated brass fittings. We shall be pleased to supply drawings and a sample to any firm interested in manufacture of this ashtray in minimum quantities of 20,000.

DOMINIQUE DE FRESTON,
Sales Director.
East Lodge,
Near Enfield Chase,
Middlesex.

# P.V.C. Extrusion Compounds

By H. D. BRETT*

*First read as a paper before the Autumn Meeting of the Swedish Plastics Federation, last year, this article discusses the relationship between customer and compounder in the p.v.c. field.*

EXTRUSION compounds from p.v.c. are versatile materials, and this paper endeavours to show how they can be formulated and processed to meet specific requirements.

The object of this paper is to emphasize the importance of close co-operation between the compounders and the extruders. Many extrusion problems can be overcome by confidential discussions between the manufacturers. Likewise, the suitability of p.v.c. materials for certain applications should be fully discussed before developing a new product. P.v.c. compounds have become so popular that they are sometimes used for extruded sections where other plastic materials would be more suitable.

Some fabricators are reluctant to give a detailed account of their requirements, fearing the disclosure of a new development. This attitude can be understood, but the success of a new product does not depend upon its sales appeal alone, but upon its ultimate performance. Any reputable manufacturer of plastics has a technical service department to advise in the selection of suitable extrusion compounds.

When a p.v.c. compound is needed for the extrusion of a new product, full particulars should be given to the compounders, stating clearly the purposes for which the material is required. The inquiry can then be dealt with in a logical fashion, as shown in Fig. 1.

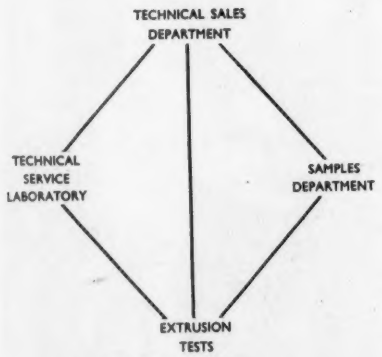



Fig. 1. Organization.

First, let us consider the technical sales department; its personnel are responsible for deciding which compound should be recommended and whether a new grade should be developed. In most instances, a compound can be selected from a standard range and then a sample of the material is dispatched from the samples department; the customer carries out an extrusion test and his report is considered by the technical sales department.

Any development problems are referred to the technical service laboratory, where the compound was originally formulated. In addition to the standard apparatus for carrying out physical and chemical tests, a laboratory of this type is equipped with pilot plant for the manufacture and fabrication of p.v.c. compounds.

The vinyl chloride polymer is, of course, the most important ingredient. There are two main methods of polymerization, emulsion and suspension, both of which types of polymer are available in several different grades, generally classified according to their K-value. In addition, there are a number of copolymers, such as vinyl chloride-acetate and vinyl-vinylidene chloride, which are often referred to under the generic name of p.v.c. Emulsion polymers are recommended for general-purpose compounds, but not for electrical insulation grades. Suspension polymers can be used for both purposes, but they require higher processing temperatures.

Plasticizers are available in an extensive range for imparting flexibility to p.v.c., greatly influencing the properties of the compounds. The primary plasticizers are usually high-boiling esters of organic or inorganic acids. There are also secondary plasticizers and extenders, such as chlorinated paraffin wax, which can only be used in conjunction with a primary plasticizer.

Stabilizers have already been described at this conference by Mr. H. Verity Smith in his paper, "The Economic Stabilization of Vinyl Chloride Polymers." To summarize, stabilizers are essential in order to prevent the thermal decomposition of the p.v.c.

Lubricants facilitate compounding and affect the extrusion properties of the compounds.

Fillers are not regarded as essential raw materials for p.v.c., although some special-purpose fillers have been developed which improve certain characteristics of the compounds. Calcined china clays are often incorporated in compounds for improving the volume resistivity of the insulation grades.

Pigments have to be very carefully selected for their heat and light stability, together with freedom from migration.

### Raw Materials

The choice of suitable raw materials for a p.v.c. compound is governed by:—(1) The service requirements of the ultimate extrusion product. (2) Production technique, such as the ease of processing when compounding, extruding and fabricating. (3) Economic needs.

When formulating, all of these factors should be considered, preferably in the sequence already mentioned. Although it is not always possible to fulfil each one of the three major requirements, the service requirements should certainly have serious attention.

Some examples of formulating to suit various applications will now be given, but these will be limited to flexible p.v.c. as the rigid grades have already been described in other papers at this conference.

TABLE 1

| Basic ingredients | Typical composition (Parts by wt.) |
|---|---|
| Polymer .. .. .. | Polyvinyl chloride .. 100 |
| Plasticizer .. .. .. | Dioctyl phthalate .. 56 |
| Stabilizer .. .. .. | Basic lead carbonate 8 |
| Lubricant .. .. .. | Calcium stearate .. 1 |
| Filler .. .. .. | Calcium carbonate .. 10 |
| Pigment .. .. .. | Titanium dioxide .. 2 |

TABLE 2—FORMULATION

| General purpose and Cable sheathing (Parts by wt.) | | Cable insulation (Parts by wt.) | |
|---|---|---|---|
| Polymer, emulsion .. | 100 | Polymer, suspension | 100 |
| Dioctyl phthalate .. | 56 | Dioctyl phthalate .. | 50 |
| Basic lead carbonate* | 8 | Basic lead carbonate* | 8 |
| Calcium stearate .. | 1 | Paraffin wax .. | 1 |
| Calcium carbonate .. | 10 | China clay .. .. | 10 |
| Carbon black .. | 2 | Titanium dioxide .. | 2 |

*Basic lead carbonate 7:1 in dioctyl phthalate.

**Table 2 indicates main difference between a general purpose compound and a grade intended for cable insulation.**

The insulation grade is based upon a suspension polymer and contains less plasticizer than the sheathing quality. It is important to note that the electrical characteristics are largely dependent upon the amount and type of plasticizer used in any particular formulation. When the plasticizer content is reduced, the insulation resistance is improved, but the compound becomes harder and less flexible.

It is appreciated that there is a need for flexible p.v.c. compounds which will remain serviceable over a temperature range of −50° C. to 150° C., but such a material is not practical at the present time. Unfortunately, the plasticizers which impart good low-temperature flexibility to a p.v.c. composition are migratory and those which have good resistance to high temperatures are unsatisfactory at low temperatures. Thus, combinations of two or more plasticizers are often used, varying the proportions until the most suitable formulation has been achieved.

Both of the formulations shown in Table 3 contain dioctyl phthalate, which is an excellent general-purpose plasticizer, giving fairly good low-temperature flexibility and adequate resistance to ageing at moderate temperatures.

In the "arctic" grade, as depicted, dioctyl phthalate is used as the basic plasticizer, but the incorporation of some dibutyl sebacate improves the low temperature performance of the compound, with only a

* Vinatex Ltd.

modest increase in cost. Where the price factor is not of paramount importance, dioctyl sebacate could be used to advantage. This plasticizer imparts exceptionally good low-temperature flexibility, combined with good resistance to ageing, but compounds plasticized entirely with dioctyl sebacate require high processing temperatures. It is logical, therefore, that a combination of plasticizers should be used in order to satisfy the various service requirements.

The heat resistant grade, as illustrated, has polypropylene sebacate as the basic plasticizer, because of its non-migratory properties and its high viscosity at elevated temperatures, giving durability under stringent conditions of service, including good resistance to aliphatic hydrocarbons. Polyester plasticizers of this type can be used as the sole plasticizer in a p.v.c. composition, but such compounds are extremely difficult to process; satisfactory results can only be achieved by compounding and extruding at high temperatures. The addition of some dioctyl phthalate, or other suitable ester plasticizer, greatly facilitates processing, although the compound will ultimately lose some of its flexibility through the migration of dioctyl phthalate. It is apparent that the proportion of ester plasticizer in the mix should be determined by the service requirements.

TABLE 3

| Arctic grade (Parts by wt.) | | Heat resistant (Parts by wt.) | |
|---|---|---|---|
| Polymer, emulsion | 100 | Polymer, emulsion | 100 |
| Dioctyl phthalate | 36 | Polypropylene sebacate | 40 |
| Dibutyl sebacate | 18 | Dioctyl phthalate | 20 |
| Lead stearate | 4 | Dibasic lead stearate | 4 |

TABLE 4

| Flame resistant (Parts by wt.) | | Transparent (Parts by wt.) | |
|---|---|---|---|
| Polymer, emulsion | 100 | Polymer, suspension | 100 |
| Dioctyl phthalate | 33 | Dioctyl phthalate | 24 |
| Tricrasyl phosphate | 22 | Dibutyl phthalate | 24 |
| Antimony trioxide | 4 | Cadmium stearate | 1 |
| Dibasic lead stearate | 4 | Dibutyl tin dilaurate | 1 |

The formulation shown has a comparatively high ratio of dioctyl phthalate, and the compound would be unsuitable for prolonged heating at temperatures over 100° C., but would have a good service life in hot climates.

Although p.v.c. compounds do not generally support combustion, the degree of flame resistance can be controlled by plasticizer selection. This can be demonstrated by flame testing two compounds, one plasticized with tricresyl phosphate and the other with dibutyl phthalate. The former mix does not support combustion, but the latter one burns readily whilst in contact with a flame.

Compounds plasticized entirely with tricresyl phosphate have poor low-temperature flexibility. It is customary, therefore, to use a proportion of dioctyl phthalate, together with a small percentage of antimony trioxide.

The transparent composition utilizes dibutyl phthalate, a virtually colourless and very effective plasticizer for gelling p.v.c. at moderate temperatures. As dibutyl phthalate is volatile, it should be used in conjunction with other plasticizers. The representative formulation is suitable for the manufacture of a virtually colourless, crystal clear compound, provided that all of the raw materials are of good quality.

A description of the various factors influencing the formulation of p.v.c. extrusion compounds must include some comments upon the economic factor. This is especially true at the present time, when extrusions have to be sold in highly competitive markets and fabricators obviously need compounds at economic prices.

Compounders of p.v.c. realize that the primary cost of an extrusion mix is in the raw materials and much development work is carried out in an endeavour to use cheaper ingredients without seriously affecting the ultimate properties of the compounded material.

The flame resistant compound could be cheapened by extending with chlorinated paraffin wax, replacing 11 parts of the dioctyl phthalate by 22 parts of the extender. This adjustment is necessary in order to maintain the flexibility of the compound and would actually improve the flame resistance, making it possible to economize still further by replacing the antimony trioxide by a cheap filler.

In the case of the transparent compound, it would not be advisable to use chlorinated paraffin wax, because the heat stability and colour of the base would be impaired. The selection of plasticizer and stabilizer combinations for a transparent compound must be in accordance with the degree of colour and clarity required in the extruded section. When a new p.v.c. compound has been developed a "Mix Card" is passed to the production department.

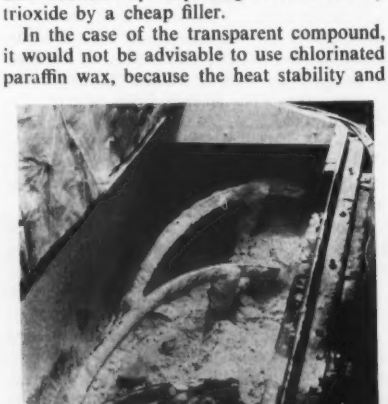


Fig. 2. Mixing compound in ribbon-type blenders.

The handling of the ingredients for premixing is not a simple matter, because of the large number of raw materials now used in the manufacture of p.v.c. compounds.

Vinyl chloride polymers are white, amorphous powders which are normally packed in 56 lb. bags. The amount of polymer needed for a premix is weighed in a counter-balanced hopper at the base of a bucket conveyor, which lifts the powder up to the mixing department and into a screw conveyor system designed to feed a battery of mixing machines.

Fig. 3. Vertical pan mixer.

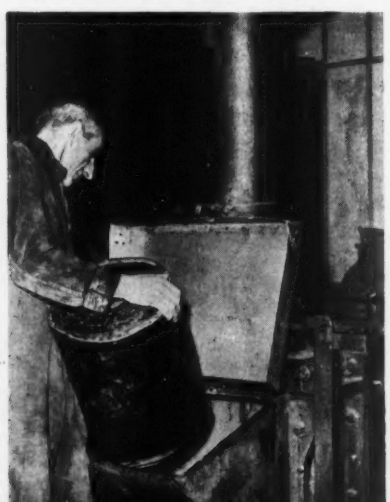
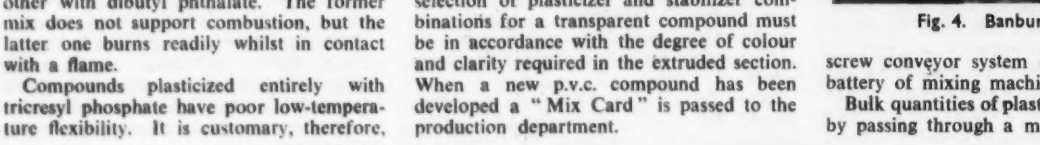


Fig. 4. Banbury mixing.

Bulk quantities of plasticizers are measured by passing through a metering system.




(Left) Progress chart for p.v.c. compounding.

Fig. 5. Mixing on hot rolls.

When small quantities of plasticizers are required, they are pumped into a specially designed tank equipped for this particular purpose. The tank is supported on a scale and the various plasticizers are thus weighed before pumping into the mixers. A p.v.c. premix usually contains all of the ingredients necessary for any particular compound, although pigmentary colouring matter is sometimes added at a later stage. Premixing is often carried out in ribbon-type blenders and the mixing period is about 20-30 minutes. The interior of a loaded mixer is shown in Fig. 2.

Most premixes are in the form of a moist powder. Premixes containing an excessive proportion of plasticizer, resembling viscous pastes, are sometimes mixed in a vertical pan mixer.

Gellation of the p.v.c. is generally carried out by intensive mixing under heat and pressure in an internal mixer. A processing cycle has to be established for each basic formulation and the conditions must be accurately controlled. Mixing is carried out by two specially designed rotors whilst the p.v.c. composition is under pressure from an air-operated ram.

After gellation, which normally takes from 5 to 15 minutes, the contents of the mixer are discharged, as a hot dough, on to a conveyor belt feeding hot roller mills, where the material is consolidated and then removed in strip form. During the roller mixing phase a colour sample is taken for checking against a comprehensive batch record system, designed to maintain uniformity of colour throughout consecutive deliveries of each shade. Colour corrections are frequently necessary and they are determined in a colour laboratory which is equipped with a small roller mixing mill.

When the compounded p.v.c. has been approved for colour, the material on the mills is stripped, cooled and granulated. A de-metallizing magnet, fitted above the delivery chute, is an effective device for removing ferrous metal contamination. The upper part of the chute is perforated, thus removing the chipping dust as the granules pass along the chute by vibration towards a suitable container. Samples of the p.v.c. compounds are then tested in a process control laboratory. One of the routine tests is to check the hardness of the compound.

Extrusion tests are especially important, both in routine control and for the investigation of customers' extrusion problems. The author has studied these problems and it is interesting to note the conflicting views expressed by different customers, even when reporting upon the same production batch of a specified compound. One customer can achieve an excellent extrusion, with a high rate of production, whilst another customer reports that the material is unsatisfactory, yielding a poor extrusion and a low output. Differences of this order are often encountered, for extrusion machines vary considerably in design, but the various grades of compound can be modified, by applying the basic principles of compounding already described, in order to obtain the best possible extrusions from each type of machine. Many of the extrusion problems associated with certain screw designs, such as poor mastication, surge, dull finish, and low output, have been overcome by the progressive re-formulation of a specified compound.

These investigations have indicated that the choice of a suitable polymer, or blended polymer system, is especially important. When blending two or more polymers, the gellation temperature should be carefully determined, as variations in the degree of gellation also affect the properties of the compound.

Other important factors are: (1) The type and amount of lubricant in the p.v.c. composition. (2) The particle size of the granulated compound.

The surface finish of an extruded section is largely dependent upon the uniform heating of the compound in the extrusion barrel and head, combined with the so-called "hot spot" in the die. These conditions are not readily attainable on some short-screw machines, although satisfactory extrusions can be obtained by incorporating breaker plates and screens in the extrusion head. The output from such machines can often be increased by using compounds based upon easy-gelling polymers, suitably stabilized, plasticized and lubricated to promote adequate flow without excessive applied heat; frictional heat should be utilized whenever possible.

Modern long-screw and multiple-screw machines are especially suitable for the rapid extrusion of an extensive range of p.v.c. materials, but the maximum performance from each machine can only be achieved when the potentialities of p.v.c. have been investigated, by co-operation between the manufacturers and fabricators concerned in the development of p.v.c. extrusion compounds.

The author wishes to thank Vinatex, Ltd., for permission to publish this paper.

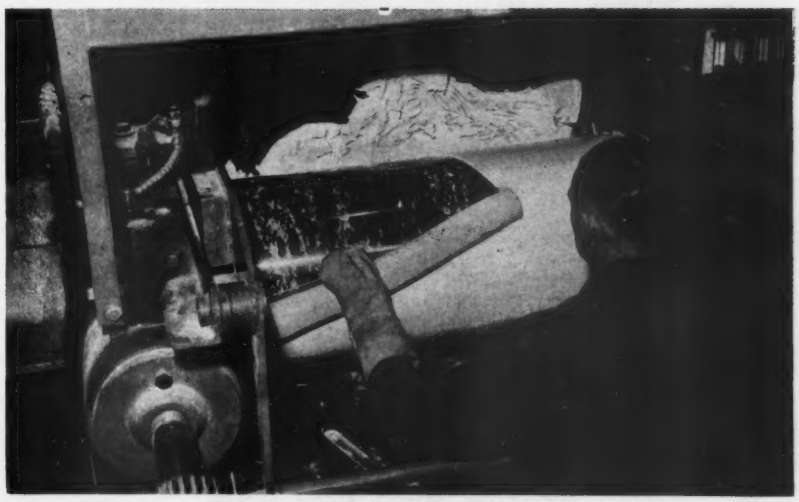


Fig. 6. Small roller mixing mill for colour correction determination.

# New Productions

**P.V.C. for Canoes**

Although much has been said about the use of glass reinforced polyester materials in the construction of boats and small craft there are other plastic materials used for this purpose. A case in point being the one illustrated here. Developed by Essex Canoes of Brentwood, Essex, the canoe has a skin of Velbex p.v.c. stretched over a rigid frame. It is claimed that the p.v.c. is less readily pierced by obstructions in the water than the more conventional canvas. Also deterioration of the material during the time when the canoe is not in use and consequent maintenance is considerably reduced. Essex Canoes are producing ready-made canoes and also kits which can be assembled by the purchaser without the use of any special equipment. A feature of these craft is their lightness which, for handling and transport, give them a deserved popularity.

Velbex p.v.c. is produced by B.X. Plastics, Ltd., Higham Station Avenue, London, E.4.

Light canoe with a p.v.c. skin constructed by Essex Canoes.

**Acid Filters**

Designed to stand up to the rigorous conditions which are inherent in the handling of fuming nitric acid the filtration unit illustrated has been produced by Porous Plastic Filter Co., Inc., of Glen Cove, New York. The filter unit is used for tank truck filtration and offers a high capacity coupled with weight and size economy. The element of the unit is a specially designed CPS-150 woven Teflon cloth which has a slot-like pore 300 microns long by 150 microns wide. This is incorporated in a stainless-steel pressure housing. The element can also be supplied with 40 and 25 micron pores. Woven Teflon fabric is made from p.t.f.e. fibres.

**Electrical Equipment**

Electro Methods, Ltd., of Caxton Way, Stevenage, Herts, announce that they have completed a licensing arrangement with Winchester Electronics Incorporated, U.S.A., to manufacture a complete range of high-grade electrical components. Production is scheduled for early April, 1956, and the following types will then be available.

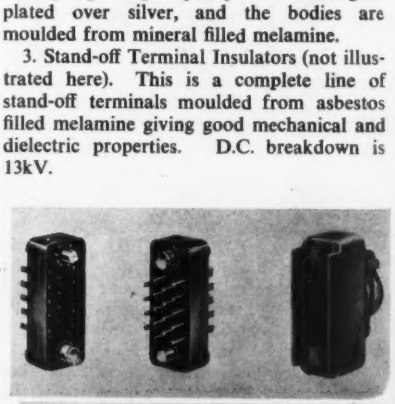
1. Series MR.E. plugs and receptacles from 7 pin to 50 pin in six ranges. All mouldings are mineral filled melamine giving excellent physical and electrical properties. Pin contacts are made of brass and socket contacts of spring temper phosphor bronze. Both are precision machined and gold-over-silver plated for low contact resistance and for prevention of corrosion and ease of soldering.

Each contact will carry 7.5A and the D.C. volts breakdown between pins, with connector engaged exceed 3,700V. at sea level and 1,050V. at 60,000 ft. Contacts to earth, the figures are 3,000V. and 950V. respectively.

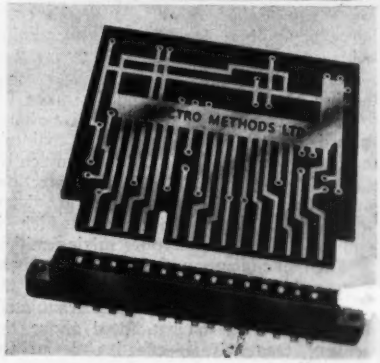
2. Printed Circuit Connectors. Series K. Printed circuit receptacle connectors function as a connecting link between printed circuitry and conventional wiring. These connectors have 5/32-in. centre-to-centre contact spacing and 5-amp. contacts. They will be available in 6, 10, 12, 15, 18 and 22 contact position receptacles. The contacts are spring temper phosphor bronze gold plated over silver, and the bodies are moulded from mineral filled melamine.

3. Stand-off Terminal Insulators (not illustrated here). This is a complete line of stand-off terminals moulded from asbestos filled melamine giving good mechanical and dielectric properties. D.C. breakdown is 13kV.

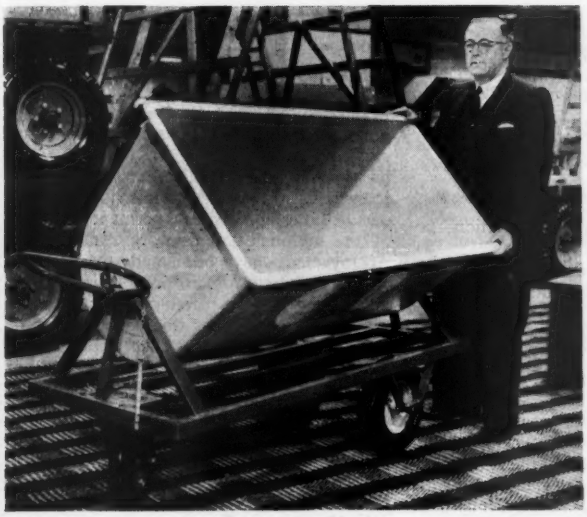
(Left) Fuming nitric acid filter cloth made from woven Teflon.



(Right) Series plugs and receptacles moulded in melamine.




(Right) Printed circuit connectors moulded in melamine.



(Left) A side-tipping truck of 1 ton capacity with a glass reinforced body.

(Right) A telephone booth for noisy locations constructed from glass reinforced plastics.

**Tipping Truck**

Seen at the Smithfield Show was the prototype of a new side-tipping truck or trailer. The body of the truck was constructed from glass fibre reinforced polyester and it has been designed for the transport of both liquids and solids. It has a capacity of one ton. One of the principal advantages of using this material for this type of application is its resistance to corrosion. An important factor when consideration is given to the materials it will be transporting and the conditions it will be used under.

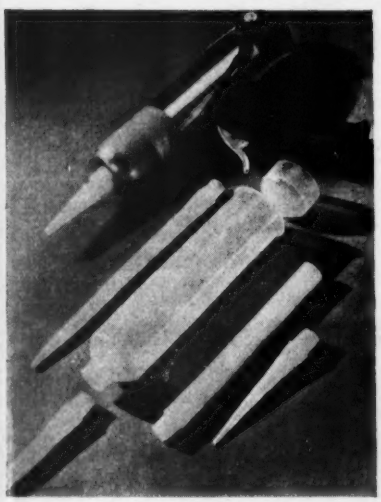
The trailer was exhibited by Chas. Pitt (Barton Stacey), Ltd.

**Sealant Cartridges**

New sealant gun designed to speed sealing operations in aircraft and other assembly work uses disposable cartridges and nozzles moulded of Tenite polythene.

Cartridges containing caulking compound fit into the gun barrel. Threaded nozzles, available in a variety of sizes and shapes, screw into the front end of the cartridges. A press of the trigger turns on air pressure, causing the sealant to extrude smoothly and automatically. When the supply of sealant is exhausted or the job completed, the polythene parts can be easily discarded to eliminate cleaning time and costs.

Small, light, and simple to operate, the gun is said to be particularly effective at close-quarters work. Since the tough Tenite polythene nozzles and cartridges do not react with, or affect the properties of, commercial caulking compounds, the gun is well-adapted for a variety of assembly jobs in the aircraft, automotive, marine and electrical fields. The sealant gun, cartridges, and nozzles, are assembled and distributed by Pyles Industries, Inc., 8926 Second Avenue, Detroit 2, Michigan. The cartridges and nozzles are moulded by Variety Plastics, 112 East Orange Grove, Pasadena, California. Tenite polythene is marketed by Eastman Chemical Products, Inc., Kingsport, Tennessee.



(Left) A sealant and caulking gun which uses polythene cartridges and nozzles. Their non-reactivity and cleanliness enhance the value of the material in this application.

**Telephone Booth**

A walk-in-type telephone booth for use in noisy locations has been produced in glass reinforced plastics by Protective Plastics, Ltd., Box No. 83, O'Connor Drive, P.O., Upton Road, Toronto, Ontario, Canada. The use of this material has enabled the fabrication of a complex shape to be easily carried out and also the good sound-deadening properties of the material enhance its value in this application. Tests carried out by the Ontario Research Foundation show that sound level reduction averages for most frequencies 10-11 db. This figure indicates that the noise level inside the booth is reduced to that which would be found in an average office.

These tests were carried out in a woodworking shop, the ambient noise being produced by running a number of rotary machines.

**Shaving Stick Container**

Latest addition to the cosmetic containers range manufactured by Universal Metal Products, Ltd., Langley Road, Salford 6, Lancs, is the one illustrated here. Manufactured for D. and W. Gibbs, Ltd., to hold the new Easy shaving stick it is moulded in three parts from two materials. The cover and base are injection moulded in polystyrene and a centre ring is moulded in polythene.

The ring has a hole which conforms to the shape of the soap, in this case fluted, and at the other end of the ring is an undercut which clips on to a flange in the polystyrene base.

Besides holding the soap firmly the ring is of convex section allowing the soap to be pushed up but gripping it to prevent retraction when pressure is applied.

The polystyrene cover is a friction fit on to the flange on the centre ring. The container is covered by patent No. 681439.

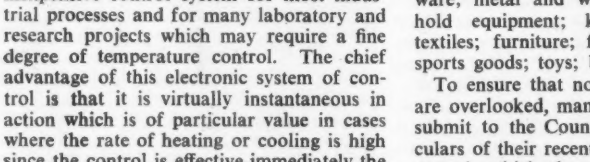
(Above) Patented shaving stick container moulded from polystyrene and polythene.

# Plastics NEWS

Raw Materials, New Plant, Works Organization, Control Apparatus, Research, Personal and Trade Notes

**TEMPERATURE CONTROLLER.**—The Foster Temperature Indicating Controller with electronic control system has been designed to provide a simple, reliable and inexpensive control system for most industrial processes and for many laboratory and research projects which may require a fine degree of temperature control. The chief advantage of this electronic system of control is that it is virtually instantaneous in action which is of particular value in cases where the rate of heating or cooling is high since the control is effective immediately the temperature drops below or rises above the desired value.

It is suitable for use in conjunction with electrical resistance thermometers, thermocouples or radiation receiving tubes, so that by use of the appropriate sensitive elements temperature ranges from −200° C. up to 2,000° C. may be controlled. Further details can be obtained from Foster Instrument Co., Ltd., Letchworth, Herts.




The new electronic temperature controller produced by Foster Instrument Co. Ltd.

**NEW LABORATORY FURNACE.**—A new high-temperature laboratory furnace for temperatures up to 1,500° C. has been produced by Siemens-Schuckert (Great Britain), Ltd., Faraday Works, Great West Road, Brentford, Middlesex.

The new furnace uses Silicon carbon tubes as the heating element. The type ST.40/4 has an internal working tube diameter of 27 mm.

**CONFERENCE.**—The British Plastics Federation announces that it will hold a conference at the Palace Hotel, Torquay, from September 27 to 30, 1956. This will be the first conference held by the Federation for members generally and their ladies. The conference programme, with details of the papers to be read, is in course of preparation and will be announced later.

**GIFTS AND FANCY GOODS FAIR.**—The seventh annual Gift and Fancy Goods Fair will be held at Blackpool from February 6 to 10 inclusive.

**MILAN INTERNATIONAL SAMPLES FAIR.**—The Board of Trade, in association with the Council of Industrial Design, will be organizing a display of well-designed British consumer goods to be shown from April 12 to 27, 1956, on the official "Great Britain" stand in the Palace of Nations at the Milan Fair.

The categories of goods to be displayed include: pottery and glass; cutlery and flatware; metal and wood tableware; household equipment; kitchenware; furnishing textiles; furniture; floor coverings; clocks; sports goods; toys; books.

To ensure that no well-designed products are overlooked, manufacturers are urged to submit to the Council without delay particulars of their recent work, in the categories named, which they recommend for inclusion in the Board of Trade display. Inquiries and submissions should be addressed to: Major-General J. M. Benoy, C.B.E., The Council of Industrial Design, 28 Haymarket, London, S.W.1.

**THE INTERNATIONAL MACHINE TOOL EXHIBITION** will be held at Olympia from Friday, June 22 to July 6 inclusive.

**INSTITUTE OF PACKAGING.**—In view of the increasing use of pre-packaging and the more scientific approach to packaging problems which prevails nowadays the Institute of Packaging has embarked on a full-scale programme of (a) education, (b) specific discussion of technical problems, and (c) professional status for packaging personnel. Proposals are in hand for the laying down of a syllabus for entrance and final examinations and the establishing of instructional courses at various centres. The first national conference is to be held in Brighton in April, 1956, and an extended programme of discussion groups for specific problems has been arranged.

**INDUSTRIAL ADVISORY SERVICE.**—Set up in 1953 by the National Union of Manufacturers with the aid of an initial grant from the U.S.A., the Industrial Advisory Service during the past two years has been of considerable service to many industries. In view of this it has been decided to establish it as a permanent feature of the national union's work for industry. Arrangements have been made to expand it so that firms can obtain practical assistance in carrying out the recommendations of the industrial adviser. For this purpose a small team of assistants have been appointed to carry out agreed programmes. They will operate under the direct supervision of the industrial adviser and appropriate charges will be made for the use of their services. Mr. G. L. Page, originally industrial advisory officer is now designated industrial adviser.

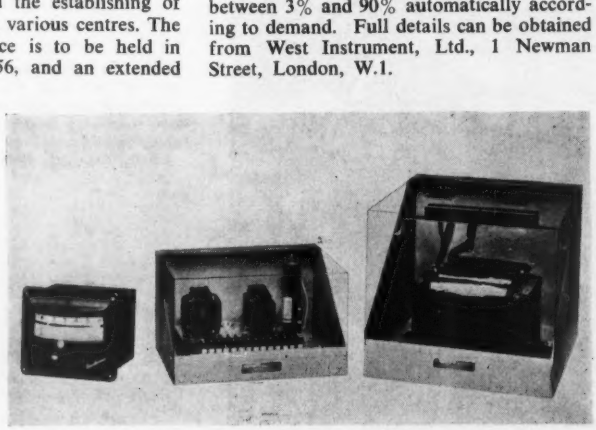
**ERINOID, LTD.**—A dividend of 7½% was recommended by the directors of Erinoid, Ltd., for the year ended July 31, 1955.

**DAVID BRIDGE AND CO., LTD.**—Trading results for the year ended September 30, 1955, show an increased balance on trading. Recommended final dividend on ordinary shares is to be 12½%.

**O. AND M. KLEEMANN, LTD.**—A final dividend of 18¾% has been recommended by the directors of O. and M. Kleemann, Ltd., for the year ended September 1, 1955. The interim dividend was 12½% making a total dividend 31¼%.

**SHARE CONVERSION.**—The directors of O. and M. Kleemann, Ltd., announce that applications have been received for the conversion of £15,458 preference stock into £3,091 12s. ordinary stock. It is proposed to issue the stock and to apply to the Council of the Stock Exchange for permission to deal therein.

**WEST INSTRUMENT, LTD.,** have produced a new stepless temperature controller designed for use with plastics machinery, electric furnaces, kilns or other electrical heating units. This controller modulates the power input to an electric load so that heat input is only equal to heat loss. This is accomplished without the use of contactors and without the use of radio valves. The controller will vary power input to load between 3% and 90% automatically according to demand. Full details can be obtained from West Instrument, Ltd., 1 Newman Street, London, W.1.



A step-less temperature controller produced by West Instrument Ltd.

**VISIT OF ANCIENT CITY COMPANY TO ERINOID, LTD.**—The Master, Warden and a Member of the Court of the Worshipful Company of Horners toured the Erinoid works at Stroud, and were entertained by the managing director, Mr. John Harvey (a Liveryman of the Horners' Company). The close association of this City company, founded in the eleventh century, with the plastics industry has revealed a gratifying keenness to encourage craftsmanship in modern production.

**P.V.C. PRODUCTION.**—The Solvic group of companies have given details of their expansion programme for the production of p.v.c. compounds. Details of the capacities of the different factories of the group are given here.

**Belgium.** The S.A. Solvic, Brussels, is increasing the capacity of its factory for producing p.v.c. and copolymers at Jemeppe-sur-Sambre to 15,000 tons per year.

**France.** The Tavaux (Jura) factory of the Societé Solvic of Paris has decided to raise its production capacity to 24,000 tons per annum.

**Italy.** The capacity of the Ferrara factory of the S.A. Solvic, Milan, was raised to 9,000 tons per annum at the beginning of this year.

**Austria.** Halvic, a sister company of the S.A. Solvic, Brussels, went into production at its Hallein p.v.c. plant during the second half of 1953 and it has been decided to raise its capacity to 3,600 tons per annum.

**Spain.** A factory of the Solvic Group is now under construction at Torrelavega in Spain. Its scheduled initial capacity is 2,000 tons per annum.

**Brazil.** The Societé Elclor, which will use the Solvic processes, is now completing the construction of its p.v.c. plant in Brazil which has a capacity of 2,000 tons per annum.

**UNPUBLISHED REPORTS.—Radiation Stability of Plastics and Elastomers:** No. ORNL 1373. The effects of irradiation on the physical properties of various types and forms of plastics and commercial elastomers are described. Most of the changes were produced in the maximum-flux region of the ORNL graphite reactor, but a number of comparative studies were made with other types of radiation. The effect of the presence of oxygen during irradiation and the effect of time of ageing, subsequent to irradiation, were also studied. The rate of gas evolution and the rate of change in volume are given for many of the materials investigated, and these and the changes in the mechanical properties of the polymers are correlated with their chemical structure. (The report is a supplement to ORNL-928. Physical Properties of Irradiated Plastics. 1951.)

**High-energy Radiation of Polymers.—A Literature Review:** No. PB 111529. A literature search was made to locate information on the effect of irradiation on the physical properties of polymers particularly with regard to oil and heat resistance and ageing. Available data is reviewed and relevant sources quoted. Based on this review, it is concluded that crosslinking can be produced in various polymers by high-energy radiation and, in a variety of elastomers, by irradiation with high-energy electrons. Natural rubber vulcanizates are improved by neutron irradiation, but the converse holds for polyisobutylene. Polyethylene showed improved resistance to heat and solvents on irradiation, which indicates that these properties as related to rubber, may also be improved.

**Low-temperature Polymeric Compositions:** No. PB 108900. This is a report of an investigation of cellulose derivatives, in the form of a film of .010 to .030 inches in thickness, for the purpose of producing polymeric compositions which would retain their strength and not undergo brittle failure at temperature down to −65° F. Detailed information is given on the synthesis of the cellulose derivatives selected, and on the preparation of films. Test methods which were developed are described and results presented in detail. A note on the characterization of polymers is included. A suitable composition, based on high-viscosity ethyl cellulose containing approx. 2.3 ethyl groups per anhydre glucose unit with methyl cellosolve stearate as plasticizers and oclyl phenol as stabilizers, was found to have satisfactory properties both at room and low temperature.

**Research in the Physical and Structural Analysis of High Polymers by Punched Card Methods:** PB 111485. Much work has been done in an attempt to deduce the linear structure of high polymers from experimental observations. The report describes the converse study, namely, of trying to determine what the properties of a material would be if indeed it were made from long chain molecules. More especially the study embraced the determination of the properties of a lattice model of polymers.

**Effects of Laminating Pressure on the Mechanical Strength of Glass-Fabric Polyester Laminates:** PB 111506. The laminates covered by this study were fabricated with glass fibre 181-114 and resins DAP 65/55, Plaskon 911-11 and Selectron 5003. Thirty-six laminates were moulded in a closed mould with resin held constant at 39% and an equal number were moulded free-edge, where the resin was free to flow. Laminating pressures of 1, 10, 30 and 50 lb. per sq. in. were used. Laminates were tested for flexural, tensile and compressive strengths, both dry and after 30 days immersion in water: flexural and tensile modulii under the same conditions; resin content, specific gravity, voids content and water absorption. The report gives details of the materials used, the preparation of fabric and laminates and test procedures. Numerical test results are given in tables and graphs for all tests. These are discussed in relation to variations of production procedures.

**Foamed Plastic Materials for Packaging:** No. IR 13526. Materials used as bases for various foamed plastics are listed. Information is given on the foamed vinyl plastisol group. These are resilient, flexible, easily fabricated, flame and chemical resistant, have high tensile strength and do not dry or harden upon ageing. One type, foamed with an inert gas instead of a chemically active foaming agent, is very economical to make and can be cured in moulds without pressure. Foamed plastics are particularly suitable for packing expensive, fragile items such as scientific and technical instruments glass-ware and pharmaceutical supplies.

**Mechanical Properties of Rigid Plastics at Low Temperatures:** No. PB 111579. Tensile modulus of elasticity, proportional limit, elongation at break, ultimate tensile strength, work to produce failure and Izod impact properties at 77°, 10°, −40° and −60° F., are given in this report, for 56 rigid plastics, representing all commercially available types. The data presented provides a uniform basis for quantitative comparisons between a much larger number of materials than was previously possible and shows quantitatively the effect of temperature on these materials. All tests were made under conditions of constant rate of load increase. Whilst conclusions must be confined to individual studies it is interesting to note, that in general, glass-base plastics showed an unexpectedly great increase in both tensile strength and elongation at break with decreasing temperatures, and that a number of plasticized compositions based on polymers having moderate strength and toughness at 77° F. gave higher strength at −40° and −70° F. than any other compositions based on the same polymers.

Copies can be obtained from Department of Scientific and Industrial Research, Technical Information and Documents Unit, 15 Regent Street, London, S.W.1.

**NEW BOOKLET.**—The 1956 edition of the booklet, "Physical Properties of Synthetic Organic Chemicals" has just been issued by Carbide and Carbon Chemicals Company. This 24-page edition features 32 new products available from Carbide and Carbon. It presents the latest data on more than 350 organic chemicals. The products are arranged by related groups with condensed data on application, and physical properties are given in tabular form.

Copies of the booklet (F-6136) are available on request from Carbide and Carbon Chemicals Company, 30 East 42nd Street, New York 17, New York.

**PROTECTIVE DUTIES.**—The Board of Trade announces that Her Majesty's Government have reached the conclusion that a case has not been made out for increased protection for p.v.c. sheeting. Application for the increase of protective duties was made in February, 1954.

**CHANGES OF ADDRESS.**—Shell Chemical Co., Ltd., announce that as from November 30, 1955, the address of their Midland Sales office is Warwick Chambers, 14-20 Corporation Street, Birmingham, 2. The telephone number—Midland 6954—remains unchanged.

Owing to the growth in the size of the Electrical Engineers Exhibition, it has been necessary to obtain larger premises to house the Exhibition company. The registered address will still remain at 23 Bloomsbury Square, but all correspondence and interviews will be carried out at 6 Museum House, 25 Museum Street, London, W.C.1. The telephone number—Museum 3450—remains unchanged.

Mr. J. D. Bruen, manager of Tufnol Glasgow office.

**NEW BRANCH.**—Tufnol, Ltd., have opened a new branch office at Ellison House, Woodlands Terrace, Glasgow, C.3, from which the sales and technical service for the whole of Scotland will be conducted. Mr. J. D. Bruen has been appointed manager.

**CHANGE OF NAME.**—Binney and Smith and Ashby, Ltd., announce that, with effect from January 1, the name of their company is changed to Columbian International (Great Britain), Ltd.

**CHANGE OF TELEGRAPHIC AND CABLE ADDRESSES.**—The telegraphic and cable addresses of Winston Electronics, Ltd., Shepperton, Middlesex, will be changed from "Control, Shepperton," to "Winston Shepperton."

**TRANSFER.**—The Mastral plating and polishing equipment business has been transferred from Kingsland Engineering Co., Ltd., to the parent company, Howard Wall, Ltd., 25-37 Hackney Road, London, E.2.

**AUTOMATION CONSULTANTS.**—Automation Consultants and Associates, Ltd., 18 Berkeley Street, London, W.1, have been formed to investigate and advise upon the successful introduction of automation to various industries.

**NEW FACTORY.**—F. N. Doig, Ltd., tool and mould makers, have taken possession of a larger factory at Coronation Road, High Wycombe, Bucks.

**INSTITUTE OF REFRIGERATION** have moved to new offices at New Bridge Street House, New Bridge Street, London, E.C.4, the telephone number is Central 4694.

**MR. C. H. GLASSEY,** managing director of British Industrial Plastics, Ltd., has accepted an invitation to join the board of Beetle-Elliott, Ltd., of Australia.

**MR. R. HART STILL** has been appointed to the board of directors of Bakelite Ltd. Other appointments are: Mr. A. J. Hearn, chief accountant; Mr. A. Lloyd, production controller; Mr. R. C. Mountford, works manager, Ware; Mr. C. D. Philippe, thermoplastics division sales manager; Mr. C. A. Robb, general works manager; Mr. A. W. Sherwood, sales promotion executive; Mr. P. Smith, general sales manager (home sales); Mr. G. J. Taylor, commercial relations executive.

**MR. W. D. C. HUSKISSON,** formerly assistant head of the plastics mould design department of E. K. Cole, Ltd., has been appointed by the United Nations to advise on mould design to the Indian plastics industry.

**DR. T. P. HUGHES** has been appointed director of the Tube Investments Research Laboratories at Hinxton Hall, Cambridge. Dr. F. P. Bowden, F.R.S., is the Chief Research Consultant to Tube Investments, Ltd.

Dr. Hughes was head of the chemistry department and subsequently chief superintendent of the rocket propulsion department of the Royal Aircraft Establishment before joining Tube Investments, Ltd.

**MR. P. C. PRITCHARD** has been appointed assistant sales manager of George Ellison, Ltd.

**MR. R. V. BRADSHAW, M.M.E., A.M.I.E.E.,** was appointed to the board of M. and B. Plastics, Ltd., as from October 13, 1955. Mr. Bradshaw joined the M. and B. group of companies in 1932.

**MR. B. WATSON,** chairman and managing director of Expandite, Ltd., has announced that two senior executives of the company—Mr. A. E. Potter and Mr. T. Pooley—have been appointed directors.

**MR. G. R. BLAKELY** has been appointed to the board of directors of G. A. Harvey and Co. (London), Ltd., as works director. Mr. Blakely joined the company in 1952 as general works manager.

**NEW FEDERATION FORMED.**—The formation of a new technical and professional association is announced. This is the Federation of Engineering Design Consultants whose headquarters, for the time being, will be St. Stephen's House, Westminster, London, S.W.1.

**MR. A. RAYMOND KEY** has been appointed vice-president of Johnson, Matthey and Co., Inc., the American associate of Johnson, Matthey and Co., Ltd.

**BIRNY MASON, JR.,** has been elected secretary of Union Carbide and Carbon Corporation. He was previously assistant secretary and assistant treasurer.

**MR. D. R. B. MYNORS** has been appointed a director of Courtaulds, Ltd. The appointment was effective from December 13.

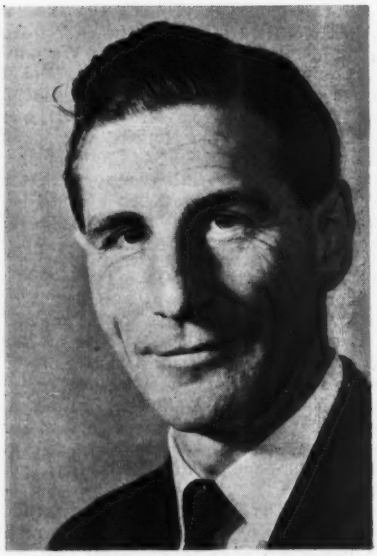
**MR. BRUCE BROWN,** formerly designer for Halex, has set up in private practice at 140 Roding Road, Loughton, Essex, as a creative product designer.

**DENIS HOFFMAN,** formerly in charge of public relations at Roles and Parker, has joined Creators, Ltd., to form a Press and public relations division.

Mr. R. H. West, formerly with Vokes, Ltd., of Guildford, has joined Creators, Ltd., as chief buyer.

**MR. TERENCE O'NEILL** has joined The Solartron Electronic Group, Ltd., as personal assistant to Mr. Eric E. Jones, the Group's commercial director.

**MR. D. E. HEAVEN.**—It is with regret that we have to announce the death of Mr. D. E. Heaven, a director of General Plastics, Ltd., with whom he had been associated for 18 years.



Mr. P. C. Pritchard, assistant sales manager of George Ellison Ltd.

**MR. R. W. E. STICKINGS.**—It is with regret that we announce the death of Mr. R. W. E. Stickings. Mr. Stickings was deputy managing director of May and Baker, Ltd., chairman of M. and B. Plastics, Ltd., and a director of Pharmaceutical Specialities (May and Baker), Ltd. He was also on the boards of the M. and B. associated Houses in Canada and India.

**CORRECTION.**—Figure 9 appearing on page 406 of the December issue of *Plastics* showed mould storage racks constructed from Handy Angle and not as stated from Dexion.

**INTERNATIONAL BUILDING AND PUBLIC WORKS EXHIBITION** is to be held in Paris from June 16 to June 28 and will have a section devoted to plastics in the building industry.

**INSTRUMENT CENTRE.**—A permanent exhibition by member firms is to be opened by the Scientific Instrument Manufacturers' Association at their headquarters at 20 Queen Anne Street, London, W.1, on February 9, 1956.

**FACTORY EQUIPMENT EXHIBITION.**—The Rt. Hon. Peter Thorneycroft, President of the Board of Trade, will open the 1956 Factory Equipment Exhibition which is being held at Earls Court from April 9 to 14 next.

**NEW PLASTICS PIPE COVERING.**—From Canada comes a new wrap-around zip-on protective jacket named Protektinsul which is made of 12-gauge Vinylite plastic to cover pipes, cables, duct and conduit insulation. Protektinsul is prefabricated to individual requirements and simply "zips" on over pipes, conduit and duct insulations—eliminating fitting, cutting and sewing—thus reducing cost in installation. The closure is a patented, electronically welded vinyl slide fastener which locks firmly into place, forming a water-tight, vapour-tight seal joint.

Hydraulic press designed for connection to a standard air line.

**SMALL MOULDING PRESS.** — The engineering division of the Barwell Rubber Co., Ltd., Swavesey, Cambridge, has just introduced a new type of compression moulding press. The special feature is that it is designed for connection to a standard air line instead of a hydraulic system. The well-known air/hydraulic method of operation is used in conjunction with a very large diameter ram, and a pressure intensifier.

It is constructed of mild steel throughout, and it has three platens, and two daylights, with a total stroke of 11 in., giving 5½ in., in each daylight when the centre platen is stopped centrally. Fixed to one side of the press is the container for the hydraulic fluid, which is pressurized direct from the air line via a quick-acting lever valve. Adjacent to this lever valve is another similar one which controls the air supply to a pressure intensifier, which is fixed to the other side of the press. By means of this pressure intensifier the hydraulic pressure in the press is increased so that, for example, 150 p.s.i. gives a loading in the press of 17.6 tons—200 p.s.i. gives 23.5 tons—250 p.s.i. gives 29.4 tons. The platens are 15 in. square and the press can be used on any air pressure up to 250 p.s.i.

**SELF-ADHESIVE LABELS.**—The Avery British Patent No. 532,018 for making self-adhesive labels, of which William Sessions, Ltd., The Ebor Press, York, are the sole licensees for this country, has been extended for a period of 6½ years from December 12, 1955, under Section 24 of the Patents Act, 1949.

**JOINT SALES AND SERVICE FACILITIES.**—In order to co-ordinate manufacturing programmes and to provide integrated sales and service facilities, Fawcett, Preston and Co., Ltd., and Finney Presses, Ltd., have formed a joint sales and service company with the title Fawcett-Finney, Ltd. The head office of the new company is at 27 Berkley Street, Birmingham.

**MR. F. E. MILLS,** until recently sales director and general manager, has been made managing director of B.I.P. Engineering, Ltd.

**THE ISOPOL CHEMICAL CO., LTD.,** of 79 Lots Road, London, S.W.10 (telephone numbers Flaxman 1061/2/3), a wholly-owned subsidiary of W. and F. Walker, Ltd., Kirkby Trading Estate, Liverpool, will be responsible for research and development of resin emulsions to customers' specification. The emulsions will be marketed as group trade names as follows:—Isolene emulsions based on styrene copolymers; Isochlor emulsions based on polyvinyl chloride; Isovin emulsions based on polyvinyl acetate.

**TECHNICAL LITERATURE,** issued by E. I. Du Pont de Nemours and Co. (Inc.), gives details of Hypalon, chlorosulfonated polyethylene, and indicates applications where it has been successfully employed. Other literature gives details of Neoprene weathering and sunlight resistance.

**BINDING CASES.**—Binding cases, in which complete copies of *Plastics* can be instantly inserted and secured, are now available. The cases are of the well-known "Easibinder" type and will hold up to six copies of *Plastics*, each copy being secured in place by means of a flexible steel wire. Covered in durable leather-cloth and with the journal's name embossed in gold on the spine, these cases may be obtained, price 12s. 6d. post free, from the publishers, Temple Press Ltd., Bowling Green Lane, London, E.C.1.

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**"Plastics in the Service of Man"**

The following is a list of full names and addresses of companies mentioned in the illustrated feature, "Plastics in the Service of Man" which appears on pages 10 to 12 in this issue:—

B.X. Plastics, Ltd., Higham Station Avenue, London, E.4.

Bakelite, Ltd., 12-18 Grosvenor Gardens, London, S.W.1.

Beatall Furniture, Ltd., Panhall Road, London, S.E.7.

Bexoid-BX Plastics, Ltd.

Compactom, Ltd., Oxgate Lane, London, N.W.2.

De La Rue and Co., Ltd., Thos., 84 Regent Street, London, W.1.

Formica-Thos. De La Rue, Ltd.

Godfrey Lampshades, London, W.C.1.

Goodearl Brothers, Ltd., High Wycombe, Bucks.

Holoplast, Ltd., New Hythe, Maidstone, Kent.

Kay Brothers, Ltd., Hurst Street, Reddish, Stockport, Cheshire.

Lacrinoid Products, Ltd., Stafford Avenue, Gidea Park, Essex.

Lactoid-B.X. Plastics, Ltd.

Rotaflex (Great Britain), Ltd., Regency Street, London, S.W.1.

Runcolite, Ltd., 3 Vere Street, London, W.1.

Staples and Co., Cricklewood, London, N.W.2.

Thermo-Plastics, Ltd., Luton Road Works, Dunstable, Beds.

Tygan-Fothergill and Harvey, Ltd., 37 Peter Street, Manchester, 2.

Vietum-Lacrinoid Products, Ltd.

Warerite, Ltd., Watton Road, Ware, Herts.

# MEETINGS

**January**

**18th.**—"Plastics Possibilities in Coal Mines", G. R. Rowell. Plastics Institute, North-Eastern Section. 7 p.m.

**18th.**—"Product Design and Plastics", R. E. Brookes, M.S.I.A. Plastics Institute, Western Section, Wheatstone Hall, Gloucester. 6.30 p.m.

**18th.**—"The Degradation of High Polymers", Dr. N. Grassie. Society of Chemical Industry, Plastics and Polymer Group, University College, Cardiff. 7 p.m.

**20th.**—Annual Dance. Plastics Institute, London Section. Grand Ballroom, Criterion, Piccadilly, London, W.1. 7.30 for 8 p.m.

**20th.**—"Vacuum Forming", L. Moncrieff; K. A. Ridley; K. R. Greer. Plastics Institute, North-Western Section, Engineers' Club, Albert Square, Manchester, 2. 6.45 p.m.

**20th.**—"Extrusion Problems", S. W. Trill. Plastics Institute, Midlands Section, The James Watt Memorial Institute, Birmingham. 6.30 p.m.

**24th.**—"Control of Corrosion in the Heavy Chemical Industry", D. R. Himsworth and W. D. Clark. The Institution of Chemical Engineers, King's College, London, W.C.2. Joint meeting with the Society of Chemical Industry, Chemical Engineering Group. 6.30 p.m.

**26th.**—"Recent Developments in Butadiene Copolymers", Maldwyn Jones, B.Sc., F.I.R.I. Plastics Institute, London Section, Wellcome Research Institution, 183 Euston Road, London, N.W.1.

**February**

**1st.**—"Silicones — their Manufacture, Application and Analysis", J. S. Hughes, B.Sc., F.R.I.C., and R. L. Bass, B.Sc., A.R.I.C. The Royal Institute of Chemistry, South-West Essex Technical College, Forest Road, London, E.17.

**2nd.**—"Polyamide Resins". Plastics Institute, Southern Section, The University, Southampton.

**7th.**—"A Study of the Chemistry of Radical Reactions by Radioactive Tracer Techniques", Professor H. W. Melville. Society of Chemical Industry, Plastics and Polymer Group, Rooms of the Chemical Society, Burlington House, London, W.1. 6.30 p.m.

**7th.**—"Liquid Atomization and the Drop Size of Sprays", R. P. Fraser and P. Eisenklam. The Institution of Chemical Engineers, The Geological Society, Burlington House, London, W.1. 5.30 p.m.

**8th.**—"A Statistical Approach to Catalyst Development", N. L. Franklin, P. H. Pinchbeck and F. Popper. The Institution of Chemical Engineers, The University, Leeds. 7 p.m.

**8th.**—"Instrumentation in the Plastics Industry", W. C. Richards. Plastics Institute, South Wales and Monmouthshire Section, Angel Hotel, Cardiff. 7 p.m.

**8th.**—"Synthetic Rubbers". Plastics Institute, Yorkshire Section, St. Mark's House, 186 Woodhouse Lane, Leeds. 7.15 p.m.

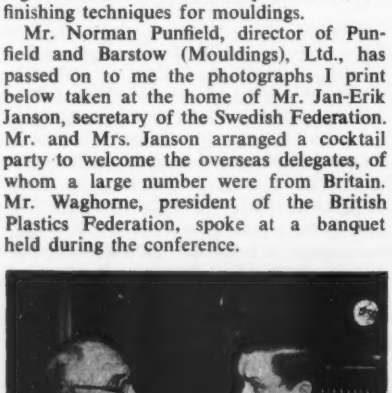
# TALKING SHOP . . .

**Polyacrylamide.** From the American Cyanamid Company has come a New Product Bulletin, No. 34, dealing with the polymer of acrylamide. This latest bulletin is typical of the very high level set by the company in its technical literature. The medium molecular weight grade of this polymer, code named Pam 75, is described in the bulletin. A stable polymer, it is easily soluble in water, being a white, odourless powder. An interesting feature is that the solubility does not decrease with increasing temperature and the weight of the concentration that can be obtained is limited only by the solution viscosity. The principal applications for this new polymer appear to be adhesives, dispersants, soil conditioning, surface coatings and as a moulding composition for the plastics industry. For example, the N-hydroxymethyl, derivative of polyacrylamide obtained by condensation with formaldehyde, has been employed. Fillers and colouring matter may be incorporated before moulding or during the resin manufacturing process and two patents are relevant, the first, British Patent 482897, and the second, French Patent No. 827059, both taken out in the name of I. G. Farbenindustrie A.G.

* * *

**Swedish Conference.** Elsewhere in this issue we are very pleased to publish two of the papers read at the Fall meeting of the Swedish Plastics Federation in Stockholm, last October. Mr. H. D. Brett, of Vinatex, Ltd., delivered a paper on p.v.c. compounding and Mr. E. C. Emslie spoke on barrel finishing techniques for mouldings.

Mr. Norman Punfield, director of Punfield and Barstow (Mouldings), Ltd., has passed on to me the photographs I print below taken at the home of Mr. Jan-Erik Janson, secretary of the Swedish Federation. Mr. and Mrs. Janson arranged a cocktail party to welcome the overseas delegates, of whom a large number were from Britain. Mr. Waghorne, president of the British Plastics Federation, spoke at a banquet held during the conference.



Mr. Charles Waghorne, president of the British Plastics Federation, talks with Mr. Jan-Erik Janson, secretary of the Swedish Plastics Federation.

**Progress in Plastics Education.** Grants totalling £3,500 had been made to students up to the end of November, 1955, it is reported by the Trustees of the Plastics Industry Education Fund. Twelve students from the plastics industry taking science courses at universities or technical colleges have been given monetary awards and others are being lent books. Of the students who completed their courses in 1955, four obtained honours degrees and three pass degrees in science subjects. Those not continuing their studies or on National Service have returned to the plastics industry.

At the Borough Polytechnic, London, seven more boys, after leaving school last September, started the full-time course for the Diploma of the Plastics Institute with the help of bursaries from the Fund. Of the bursary holders who completed the Diploma course last July, six are employed in the plastics industry and two are continuing their studies for the Associateship of the Plastics Institute.

Six students at the Birmingham College of Technology holding scholarships from the Fund are in the second year of the course leading to the Associateship of the Plastics Institute. It is also hoped during 1956 to help, by scholarships, boys taking the "sandwich" course in plastics technology at the college.

The Trustees have offered a research studentship in Plastics Technology of £300 a year at Acton Technical College. Applications for this have been invited.

The Plastics Institute is revising the brochure "Careers in Plastics" for circulation to schools throughout the country and for distribution at the Christmas Lecture for Young People (January 2, 1956). The cost of republication of this brochure, which has successfully drawn the attention of school leavers and others to the opportunities in the plastics industry, is being met by the Education Fund.

Further progress is reported in the publication of monographs by the Plastics Institute, which are financed by the Trustees.

Two recent publications are "Phenolic Resins," by A. A. K. Whitehouse, and E. G. K. Pritchett and "Transfer Moulding" by J. Butler. It is hoped that four more monographs will be published within the next few months.

* * *

**Dr. Drakeley Retires.** On Saturday, December 10, nearly 800 past and present members of the staff of the National College of Rubber Technology and the Northern Polytechnic gathered in the Polytechnic's theatre for a presentation party in honour of T. J. Drakeley, C.B.E. Principal of the Northern Polytechnic since 1931, Dr. Drakeley went to Holloway in 1918 to become Head of the Chemistry Department. During his second year he revived the Rubber Trade School and successfully promoted the formation of the National College of Rubber Technology in 1948.

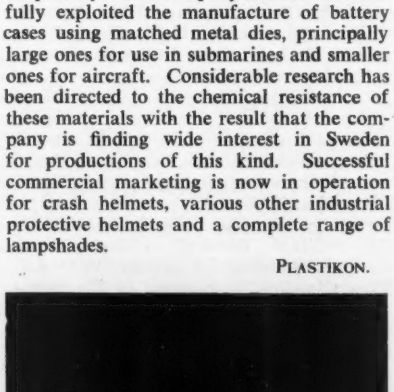
There will be many in the plastics industry who, having known Dr. Drakeley either as a teacher or in his business capacity as a director of the Phoenix Rubber Co., Ltd., will wish to be associated with the good wishes offered by his staff on December 10. A man of very wide interests, he is held an expert in rubber technology, education and milk technology, having been for many years consultant chemist to the Dairy Farmers Association. His recreations are mountaineering, together with a close personal interest in all of the extra mural activities of the Polytechnic, ranging from its very active repertory group to the cricket club.

Probably no polytechnic principal has worked harder in bringing to full fruition the activities of an education centre which was founded by Queen Victoria in 1892 at a meeting of the Privy Council at Osborne House. In recognition of his brilliance as a teacher and administrator and his warm interest as a friend, he was presented with a cheque and a wrist watch. This occasion was the personal expression of the regards of his colleagues, and later in the month he was the guest of honour at a formal dinner given at the Rembrandt Hotel, London, where another presentation was made.

* * *

**Reinforced Plastics Developments in Sweden.** The chief chemist of Aktiebolaget Malmo Flygindustri has kindly sent me details of some of his company's work with glass fibre/polyester resin laminates. One of the larger mouldings which has been produced is a 6,200-litre road oil tanker for the Swedish Shell Company and a 1,000-litre cylindrical tanker for the transport of a wide range of liquids. This latter tanker is a standard moulding and may be produced in quantity. The company has also successfully exploited the manufacture of battery cases using matched metal dies, principally large ones for use in submarines and smaller ones for aircraft. Considerable research has been directed to the chemical resistance of these materials with the result that the company is finding wide interest in Sweden for productions of this kind. Successful commercial marketing is now in operation for crash helmets, various other industrial protective helmets and a complete range of lampshades.

PLASTIKON.



Mr. Waghorne and Mr. N. B. Punfield with Mr. H. Nystrom, chairman of the Swedish Plastics Federation.

# The Properties and Testing of Plastics Materials—Part 2 (Cont.)

Sections 11, 12, and 13. Adhesion, Bond Strength, Ageing, and Friction

By A. E. LEVER,* A.I.R.I., and J. RHYS,† M.Sc.

## Section 11. Adhesion, Bond Strength

IN any strength of adhesives, at least two strength factors are being tested simultaneously:—(1) The strength of adhesion of the adhesive to the adjacent surface. (2) The strength of the cohesion of the adhesive itself.

The qualities that may be said to define the working qualities of an adhesive are:—(a) Consistency; (b) Storage life; (c) Pot life; (d) Spreading rate; (e) Assembly time; (f) Tack and blocking; (g) Penetration; (h) Slippage and flow; (i) Cure.

The difficulties of testing are discussed (1) and a resumé of methods of testing (2), including shear, stripping, impact, fatigue and wet strength tests. There is also a good description of tests for adhesion and cohesion (3).

Some factors affecting adhesive bond formation are discussed (5) including such factors as pressure, bond thickness, temperatures, etc.

It is not inappropriate to give some brief details of some of the methods used for testing the adhesion of paints (4) particularly when the increasing use of synthetic resin paints is considered.

**Courtney and Wakefield Test.** A thin metal foil forms the base material, the other side of the paint film being cemented to a horizontal steel panel. The force required to break the bond between the paint film and the foil is recorded.

**Schmidt Tensile Test.** A stress is applied to the paint film in a direction at right angles to its surface via a block of wood glued to one surface of the film.

**Gardner-Parkes Tensile Strength Meter.** Similar to the Courtney method but it uses a strip of silk fabric embedded in the film instead of the metal foil.

**Gelva Test.** Similar to the Schmidt test but a metal plug is used instead of the wooden block.

**New York Production Club Method.** Similar to the Schmidt method.

**Mandrel or Bending Test** (G.E.C. and M.o.S. Types). The adhesion is gauged by the ability of the film to withstand extension without parting from a metal base. A series of mandrels of different diameters are used.

**Enclisen Tester.** Indentation is produced by slow pressure on a steel ball. A scale indicates the extent of vertical distortion of the test panel.

**Knife Tester.** A scratch is made with a knife under controlled pressure.

**Scratch M.o.S. Test.** A scratching needle having a hardened steel or hard alloy hemispherical point fixed at the end of a counterpoised arm is used.

**Moses and Witt Tester.** The force required to separate the paint film from the base is applied by producing very rapid alternating longitudinal vibration in a metal cylinder at ultrasonic frequencies.

**The Peeling Tensometer** (6). This has been developed for measuring the peeling strength of adhesive joints in which one, or both, substrates are flexible. It is manually operated and the load is measured by the deflection of a beam. Autographic recording is included.

**The "H" Method** (7). This has been developed for evaluating the adhesive properties of tyre cord in natural and synthetic rubber and is worth studying. Data is given on tests made with nylon, rayon and cotton cords.

**Ultracentrifugal Adhesion Tester** (19). It is claimed that this instrument gives a true adhesion failure and is independent of film thickness, and elastic properties of the material under test. It has been developed for the evaluation of protective coatings.

The force required to strip adhering materials apart at constant speed fluctuates rapidly as the stripping proceeds. In order to measure and record these fluctuations a machine has been evolved and is described (8).

The time taken for a catalyzed resin to gel is called the "Gelation Time." A self-indicating apparatus is described (9) for determining this time. There is also a method for determining the setting time of hot press adhesives (10).

An apparatus for assessing the heat-sealing range of this type of adhesives is described (11) including a method for preparation of the film. Bond stability and sealing temperature may be determined.

The mechanical properties of laminates show great variation according to the direction in which the stress is applied (12). A load parallel to the direction of lamination is mainly supported by the filler (e.g., paper or fabric). A load perpendicular to the direction of lamination is carried only by the binder between the laminations (i.e., adhesive).

This property has been tested by determining the resistance to splitting, in which a standardized wedge is placed on the specimen parallel to the direction of lamination, and loaded by a weight. The splitting resistance is that load which splits the sample. An improved test is also described which determines the bending stress.

An American specification (13) gives methods for determining the bond strength or ply adhesion strength of sheet plastic and electrical insulating materials, e.g., laminated phenolics, melamines, and vulcanized fibre. When applied to non-laminated plastics, the test measures the cohesive strength and is of fundamental aspect. It has not been correlated with the results from other methods of testing bond strength, and has been designed so that failure between the adhesive and the metal should not occur.

A summary of conditions for testing adhesives and plastics according to A.S.T.M. and Federal Specification methods is given (14).

A method is described (12) whereby all the component sheets in a laminate are tested, and another experimental adhesion testing machine is briefly described and illustrated (15).

The adhesion of print on to printed p.v.c. sheet is determined on the Crockmeter apparatus which is described (16).

A dynamic compression test for adhesion of rubber to cord fabric is described (17). A single cord surrounded by a thick cylindrical sheath of rubber is subjected to cyclic bending and compression across one diameter, whilst the cord sustains a steady tension. The ambient temperature is maintained at a suitable level. Deterioration of the rubber-cord bond is expressed in terms of the load required to pull the cord from the mid-portion of the sample, before and after test.

The testing of adhesives for plywood is covered in a British Specification (18). A list of timbers both suitable and unsuitable for this test is given.

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## Section 12. Ageing (Natural and Artificial)

NATURAL ageing is exposure of a test piece to the conditions that the final product will encounter when under normal service conditions.

**Accelerated ageing** is exposure of a test piece to any set of conditions designed to reproduce in a short time, the deteriorating effect obtained under normal service conditions.

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Few accelerated ageing tests correlate entirely with natural ageing tests, but give a good indication as to what is to be expected. One type of test may be more severe than another, and only long experience of both methods, for any one material, can give confidence in the results obtained.

Light sources used in accelerated tests have been examined (1). The high-intensity arc is the nearest to noon sunlight in spectral characteristics.

A new oven (2) for testing the ageing of plastics is fully described. The lower section of the oven houses the electrical equipment, and the upper section is fitted with an asbestos base through which eight 4-in.-dia. specimen tubes can pass. The lid of each specimen tube contains 5 by ¼-in.-dia. holes to enable the air flow to be controlled. See also (27).

For testing the resistance of a material to artificial sunlight and fog, the S-1 Bulb and Fog Chamber is used (3). Full details of the apparatus are given.

Accelerated ageing tests covering changes in atmospheric temperature and humidity, but not to direct sunlight and weathering, are described (4). Six procedures cover exposures at different temperatures and degrees of humidity, and one for alternate high and low temperatures.

A light and weather exposure apparatus of the carbon-arc type is described (5).

A test for the behaviour of ethyl cellulose under fluctuating conditions of warmth and dampness (6) uses a cabinet containing water, operating at 55° to 60° C. during an eight-hour day, and giving approximately 70% R.H. The chamber is allowed to cool off during the night, the humidity rising with condensation to 100% R.H.

A similar test was used (7) to assess the ageing characteristics of plastic films for small coil insulation. Tables of properties of several plastics are given.

A method for evaluating the thermal ageing stability of flexible sheet insulation has been developed (8) using the dielectric strength of the insulation as the failure criterion.

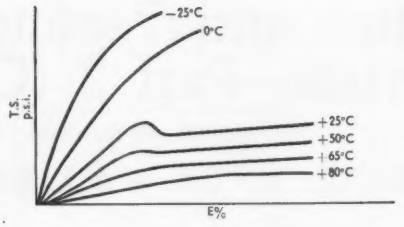
Samples of flexible sheet are aged at elevated temperatures and then subjected to a dielectric stress in an electrode system which elongates the sheet approximately 1%. The time required for average dielectric strength to drop to a predetermined level is the life of the insulating material.

Plastics for special purposes, e.g., aircraft, may have to withstand temperature changes of −70° F. to 200° F. (9).

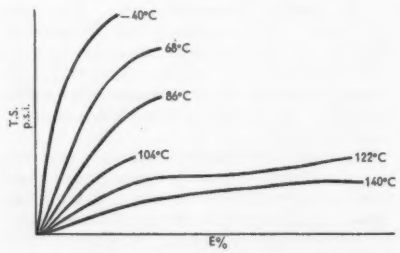
Thermoplastics show the following changes as ambient temperature changes:—(a) The slope of the initial elastic portion of the curve decreases as the temperature is increased. (b) The maximum stress at yield point decreases as the temperature is raised. (c) The point of rupture tends to move along the curve to higher values of strain as the temperature is increased.

Thermosetting materials show:—(i) As in (a) above but to a lesser degree. (ii) As in (b) above but to a lesser degree. (iii) There is some tendency for the point of rupture to move along the curve as in (c) above.

The effect of temperature on the stress-strain properties of cellulose acetate illustrates these points:—

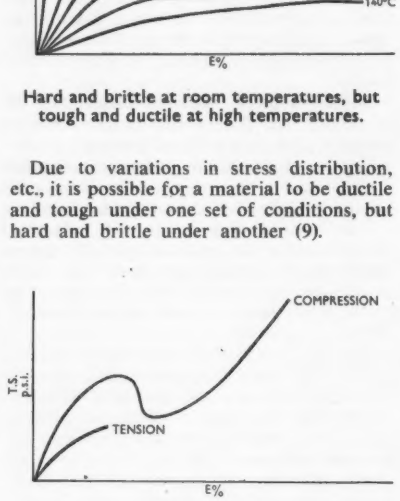



Hard and brittle at low temperatures.




Hard and brittle at room temperatures, but tough and ductile at high temperatures.

Due to variations in stress distribution, etc., it is possible for a material to be ductile and tough under one set of conditions, but hard and brittle under another (9).




Polystyrene.

In an investigation to determine how the exposure temperatures affects the deterioration of vulcanized elastomers, it was shown (10) that for most of the synthetic elastomers the mechanism of deterioration is essentially the same over the temperature range from room temperature to 150° C., the rate depending on the temperature in a regular way.

Ageing tests on p.v.c. cables (11) are essentially the exposure of samples of the p.v.c. cut from the cable core and sheath, exposed to a temperature of 82.2° C. for 120 hours. The loss in weight is considered to be an estimate of the degree of ageing.

Another test (12) uses a grommet which is deformed so that the opposite ends of the internal diameter meet at the middle and these are then bound in the middle with soft iron wire so as to form a figure "8." The assembly is then exposed to the desired conditions.

A multi-cell ageing oven for plastics or rubber contains separate compartments for ageing different compounds (2).

A non-destructive test for determining the resistance of rubber to ozone and heat is described (13). One method measures the volume resistivity of a stretched T.50 sample as the ozone cracking increases. The cross-sectional area decreases and the volume resistivity increases. Other methods use a permanent set apparatus and strain tests at low elongations, so that adverse effects such as permanent set or tearing are eliminated.

Some relationship between ageing and relaxation rates for rubber vulcanizates is found (14) and the work is based on a slightly modified form of the Firestone Balance (15).

A satisfactory apparatus and method have been developed (16) for testing the effect of long-time ageing of elastomers under load. It includes a determination of change in modulus as well as the total amount of creep. It is believed that this method approximates service conditions better than other ageing tests. The apparatus is described.

While specifically dealing with rubber (17) the following information is of value when considering synthetic elastomers:—

**Exposure Cracking.** When stretched rubber is exposed to outdoor atmospheres, a series of cracks may appear with their length perpendicular to the direction of the applied stress.

**Sun Cracking.** This is the result of light catalyzed oxidation which leads to the formation of a resinous skin on the surface of the rubber which eventually cracks. The cracks have no preferred orientation but eventually link up to form a continuous network.

The type of cracking produced by ozone depends on the amount of strain present in the test piece. A type of test piece is shown which, when stretched, will give a range of strains. If clamped to boards, the boards should be varnished to prevent decomposition of the ozone by the wood.

In using accelerated ozone tests, the use of too high a concentration of ozone should be avoided as some substances which protect vulcanizates against low concentrations of ozone, fail to give protection at high concentrations.

Increased concentration of ozone necessary for an accelerated ageing test can be obtained by ozonizing air with short-wave U-V radiation (18).

An extensive investigation of the oxidative ageing of polythene (19) indicates that the tests of Walldet and others (20) on the artificial ageing of polythene were fairly accurate. They found that exposure to a bare carbon arc for 100 hours is roughly equivalent to one year outdoor exposure.

A variety of clear transparent plastics were exposed under different climatic conditions (21). Several interesting tables are given of the results.

An evaluation of lightweight polyvinyl butyral on nylon fabric for rainwear is reported (22). Various plasticizers were used. It is stated that phosphates are relatively resistant to mould and fungus attack, but sebacates are vigorously attacked. Sunlight exerts a greater effect on plasticizer loss than microbiological attack, but plasticizer loss may occur from both causes.

Flexural modulus is one of the most important factors in determining coating characteristics. The Tinius Olsen Apparatus was used (23).

An apparatus is described (24) for the evaluation of rubber and rubber-like materials at various temperatures under

static and dynamic conditions at low concentrations of ozone kept automatically constant. See also (25).

It is sometimes necessary to evaluate a plastic for exposure to salt water and a suitable test is described (26) as is known as the Salt Spray Test. Tests for complete immersion of the article may also be required.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## Section 13. Friction

THE frictional properties of linear plastics under various loads are discussed (1).

When a plastic slides on harder metal than the plastic itself, adhesion occurs between the two surfaces, and shearing takes place in the plastic. When it slides on a softer metal then shearing occurs in the metal.

P.t.f.e. is different in that adhesion is very small and shearing occurs at the interface.

Using radio active metal, it has been shown (2) that adhesion occurs when metals and plastics are pressed together and slid over each other.

The static and kinetic frictional properties of some unplasticized high polymers have been investigated (3). A Bowden-Leben "stick-slip" machine was used. The work supported the conclusion that major component of the frictional force is due to the strong adhesion which occurs between the steel ball and the plastic, resulting in a shearing in the plastic below the interface.

| | Shear strength, kg./mm.$^2$ | Yield pressure | Coeff. of friction |
|---|---|---|---|
| Polytetrafluorethylene.. | 1.68 | 4.0 | 0.10 |
| Polythene .. .. | 0.91 | 2.97 | 0.33 |
| Polytrifluorchlorethylene | 3.32 | 15.9 | 0.43 |
| Polyvinyl chloride .. | 5.05 | 14.9 | 0.45 |
| Polyvinylidene chloride | 4.06 | 6.67 | 0.68 |

A frictional meter enabling the coefficient of friction to be measured directly is described (4). One of the contacting materials is carried on a platform supported by four parallel counter-balanced arms, which indicate the direction of the contacting force, and hence to coefficient of friction.

A description is given (5) of the test rig used by Dunlop for determining the coefficient of friction on a steel test drum. It can be cooled on the inside with dry ice, and then water is sprayed on to the drum, the ice forming being dry or wet as desired.

A method is described (6) for measuring the coefficient of friction at low speeds by means of a normal dynamometer for rubber testing. The apparatus allows variations of load and speed.

Data on the coefficient of friction of soft vulcanized rubber are given (7) and some factors affecting the property are noted.

The friction behaviour of moulded plastics in sleeve bearings has been reported (8).


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# Plexidur—A New Material For Orthopædic Work

*Details of progress with this material in the surgical field*

THROUGH the co-operation of P.D.I., Ltd., Birmingham, we have received some information from Rohm and Haas, G.m.b.H., on Plexidur, with specific reference to its use in orthopædic work. A mixed polymerisate on an acryl basis, Plexidur is a clear, transparent material with a light yellow-brownish colour, the intensity of which increases proportionally with the thickness of the sheet. A list of physical properties is given in the table, and an interesting feature is that the impact strength is at least 100% higher than that of Plexiglas.

For the manufacture of orthopædic aids, particularly foot supports, Plexidur is supplied in shaped blank form or as sheet material. The blank forms are manufactured in such a manner that in most cases no further machining is necessary. Should any alterations be required in the shape it is necessary to make such alterations before the blank has been moulded rather than afterwards.

The machining properties of the material are good, it being necessary to make use of high-quality cutting tools as is the case with most plastics to avoid overheating. Cooling with drilling emulsions or water is required and, where extensive fabrication is carried on, adequate provision for fume ducting is necessary.

The heat treatment of either sheet or blanks calls for critical control. At 140° C. Plexidur assumes a rubber-like softness, enabling it to be moulded without strains, but to achieve satisfactory results heating must be carried out in accordance with the manufacturer's specifications. To subject the material to temperatures of above 140° C. leads to embrittlement and decomposition and all heating apparatus should, therefore, be fitted with automatic temperature control to ensure that the optimum figure is not exceeded. Amongst the moulding processes that can be employed with this material are negative moulds and sponge rubber, positive moulds, matched steel dies, and moulding direct on to the foot.

**Properties of Plexidur**
(Testing temperature 68°F. (20°C.)

| | | |
|---|---|---|
| Specific gravity .. .. .. | | 1.17 |
| Tensile strength .. .. .. | lb./sq. in. | 14.000 |
| Elongation at break .. .. .. | % | >30 |
| Stability under permanent load: (5,000–8,000 hr.) | | |
| Smooth rod .. .. .. | lb./sq. in. | 5.500 |
| Notched rod .. .. .. | lb./sq. in. | 5.500 |
| Bending strength .. .. .. | lb./sq. in. | 22.000 |
| Modulus of elasticity (through bending) .. .. .. .. | lb./sq. in. | 640.000 |
| Impact strength .. .. .. | | |
| Coefficient of linear expansion × $10^6$ | mm./mm. °C | 66 |
| Vicat's dimensional stability .. | °F. | 203 |
| VDE indentation hardness: | | |
| Ball Ø 5 mm. .. .. .. | lb./sq. in. | 27.000 |
| Load 50 kg. .. .. .. | lb./sq. in. | 25.000 |
| Vicker's hardness (150 g 15") .. | °F. | 30.000 |

The development of the material for orthopædic treatment has been active since 1948. One of the advantages claimed for the material, particularly for use as a foot support is that it permits a much easier and effective individual fitting than has been possible with other materials. Modifications can also be made to a blank after it has been in use. The high elasticity of the material permits the easy movement of the foot and, therefore, makes for greater ease of use than would be the case of metal supports, where virtually no movement would be experienced at all. Cold flow is not experienced under normal conditions and the supports retain their shape during prolonged use.

Finally, the resistance to corrosion of the material commends it as an alternative to metals, and the low specific gravity is also a great advantage.

Detailed literature of the fabrication of Plexidur is obtainable from Rohm and Haas, Darmstadt, Germany. Readers may be interested to know that Plexidur was used in the construction of a magnificent stairway on the stand of Rohm and Haas at the Düsseldorf plastics exhibition last autumn. Special note of this was made in the November, 1955, issue of *Plastics*, pages 370-371. The material was, however, incorrectly referred to there as Plexiglas, the normal acrylic polymer made by Rohm and Haas.

# Barrel Finishing Methods For Plastics

## By E. C. EMSLIE

*Mr. E. C. Emslie, of Lacrinoid Products Ltd., read the following paper before the Autumn Meeting of the Swedish Plastics Federation, in Stockholm last year. A detailed survey of barrel finishing techniques is given.*

IT is probable that high among the various problems facing the plastics industry must come final finishing and polishing, and I feel there is undoubtedly much time and money wasted by failure to explore all possible methods. An order usually goes to the firm who, by the application of up-to-date methods, can produce more quickly and cheaply than their competitors, and how often can failure be traced to the finishing shop. It is not unusual to see dozens of operators removing flash with files, when the correct application of a mechanical method could have carried out the operation more efficiently, more cheaply, and more quickly. Obviously, in many instances individual handling is necessary, particularly where large intricate articles are concerned, but very often this method is adopted without consideration being given to an alternative. Where a time cycle of moulding allows the operator to carry out certain deflashing operations at the press, this obviously means distinct saving especially where intricate internal flash can be removed by the installation of a carefully designed tool. Some very neatly made broaching tools designed to deflash a particular moulding are in use and very often it is hard to improve upon them, but this does not always apply, and my object is to discuss the method which over the last few years has made great strides. This is known by various names, rumbling, tumbling, barrelling, but all entailing the use of a metal or wooden barrel rotating at a fixed speed. Let us draw a mental picture of a barrel which we can expect to give us the best results, whether for deflashing, smooth finishing or polishing. It may be made of metal which would be with or without lining, it may be of wood fitted with wire-mesh panels, or it may be entirely of wood with solid panels. In every case, I always prefer the eight-sided or octagonal barrel, and for a very good reason.

Whatever its purpose, it is necessary to maintain a flow or slide in the barrel without any fall, and in order to assist this flow the mass must, with certain exceptions, be lifted and not allowed to roll at the base. (See Fig. 1.)

The eight-sided barrel will give better results than barrels of either round-, four- or six-sided design. The flow can be either increased or decreased by the speed of the barrel in conjunction with barrel diameter, also taking into consideration the type of work, particularly as to weight and size. It does not always follow that better results can be obtained by fast speeds, which tend to over-lift the mass, thereby reducing weight and causing damage to the work load which would otherwise barrel perfectly. We can now consider the type of barrel for particular jobs, starting with a wire-mesh barrel designed principally for the deflashing of compression mouldings (Fig. 2).

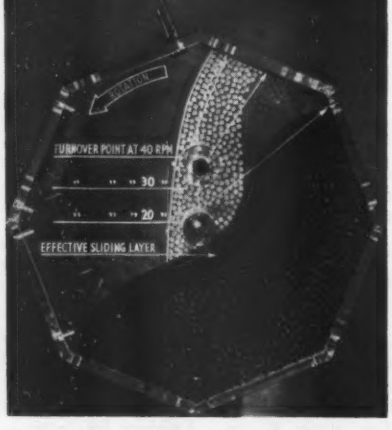



Fig. 1. A Perspex model showing design features of octagonal barrel.

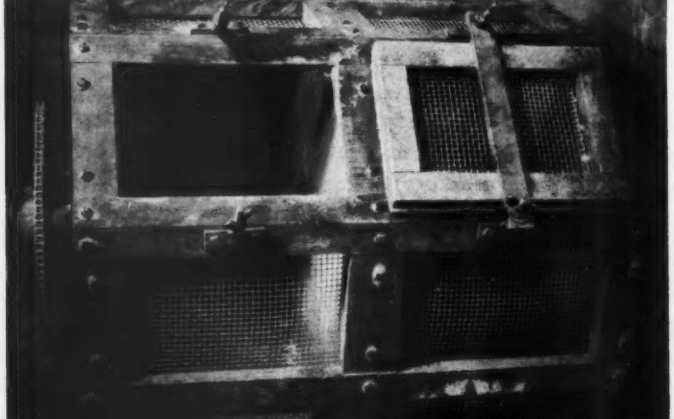


Fig. 2. Conventional wire-mesh barrel.

The wire-mesh barrel can be used to remove the outer flash of mouldings, and has the advantage of causing little damage to the external surfaces. In many cases after flash removal by this method, where polished surfaces are not essential, the moulding needs no further finishing and is ready for the assembly shop or despatch. Barrel speed and mesh size play a large part in its successful use, the usual mesh sizes being $\frac{1}{8}$ in., $\frac{1}{4}$ in., $\frac{1}{2}$ in. and 1 in., depending upon the type of moulding to be barrelled. It should be remembered that a finer mesh will give smoother flash lines but will tend to keep the flash in the barrel and cause scratching on the surfaces of the mouldings. A mesh of four squares to the inch is a good standard. The flash is broken off from the main section of the moulding by striking against the wire, and passes through the mesh to discharge itself on to the floor of the workroom or into a suitable container.

Barrel speed is all-important and can mean the difference between a good or bad finish, and must be decided entirely according to the actual moulding and required finish. Damage can be caused by a barrel running too fast and, here again, the steady flow of work in the barrel is essential. Based on a barrel diameter of 30 in. from flat to flat or panel edge to panel edge, speeds can vary from 10 to 50 r.p.m., and final decision can only be made in the light of experience. Small electrical mouldings, cabinet knobs, and buttons are typical examples of articles suitable for wire-mesh barrelling.

An important point to remember is that after wire-mesh barrelling the mouldings will probably have collected a certain amount of dust caused by the break-up of flash and it is often necessary to wash the articles before further operations. If barrel polishing is intended, washing after wire-mesh barrelling is absolutely essential. In some instances, barrels with solid wooden panels are used for deflashing but, as with the very fine mesh, the flash has no means of being freed from the barrel during running time and the sharp edges tend to scratch the surface of the moudings. A lid fitted with wire mesh will help to clear the flash. A few blocks of wood added to the load will assist to break off heavy flash. Thus, the wire-mesh barrel is very useful for certain types of mouldings but cannot be expected to clear internal flash or give a perfectly smooth flash line.

Therefore, we must find a method which will greatly assist in such cases, and very often the metal watertight barrel is the

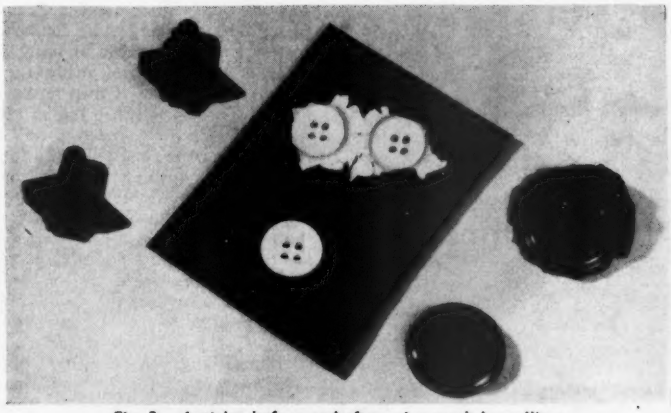


Fig. 3. Articles before and after wire-mesh barrelling

answer. Again, this barrel should be eight sided, lined with rubber if possible, and the fitting of a variable-speed motor is an asset. I would like to explain at this point that I shall use the term "media" when referring to any material used in a barrel to deflash or polish components. This would be material such as aluminium oxide chip, polishing pegs, finishing balls, etc.

Such a barrel would have the following uses:—

1. For self-barrelling when mouldings are loaded into the barrel together with a water content and a detergent, and allowed to deflash against each other.
2. For deflashing compression mouldings with internal flash lines using steel ball, natural chip or fused mineral chip as a media.

### Self Barrelling

As I have explained, the wire-mesh barrel has limitations, particularly as regards the really smooth flash line, and dust is also a problem. Therefore, where the use of water would not be a disadvantage (I am thinking in particular of interference with the insulating properties of the moulding) self barrelling will greatly assist. The barrel is loaded up to ⅔ of its capacity with the mouldings, water added up to the level of the load, a detergent added, and the barrel rotated allowing the mouldings to deflash against each other using the water, already softened by the detergent, as a protection. Flash lines can be run down to much finer finishes by this method as danger of damage is reduced to a minimum. The barrel can be run faster, thereby increasing the deflashing effect, and the mouldings are washed in the barrel during the process. Drying after barrelling is obviously necessary. The load in the barrel must be reasonably heavy to give weight to the deflashing action. Admittedly, the flash is trapped in the barrel but the water protects the surfaces from scratch, and the flash will wash away when the barrel is unloaded. As an example, a well-known British firm are deflashing thousands of phenolic distributor covers by this method. Five hundred covers are loaded into the barrel and deflashed in 25 minutes. After drying by centrifugal dryer, the covers are ready for spraying, and it is estimated that the work of six finishing operators has been saved on this one item.

Whereas mouldings can be deflashed using wire-mesh barrels or self barrelled, these methods can only deal with outside flash lines and cannot clear holes or internal sections.

Therefore, although the actual barrel used is the same as the self-barrelling type, it is necessary to add a deflashing media which can penetrate, break away, and clean flash with as little damage to surfaces as possible. It is not advisable to use a harsh abrasive on phenol formaldehyde owing to the danger of exposing the filler, a condition which cannot be easily rectified. A steel or die-cast ball of a size which will pass through any holes or apertures is used on phenolic mouldings and, here again, water is used as a protective agent. Having decided on the size of ball required, and sometimes a variety of sizes is necessary to enter various sized sections, the barrel is loaded with a proportion of ball and work, usually 2 or 3 parts ball to 1 part work, water added level with the total load, detergent added, and the barrel run at a fixed speed. The balls will break away the flash and smooth down the flash line. Where phenol is concerned, care must be taken that the running time is not too long, although the quality of the moulding plays a very great part and the thickness of the flash is all-important. Very often extensive modification work on the moulding tool is justified in order to reduce flash thickness and enable mouldings to be barrelled. A .003-in.-.005-in. flash can usually be handled successfully. Again, barrel speeds vary based on the diameter of the barrel but, as an indication, 10-15 r.p.m. is usual on a barrel of 30-in. diameter. Where high insulation is important, the question of tracking must be considered where metal balls are used. On urea formaldehyde mouldings the position is very different. Natural stone, such as granite or fused mineral oxide chips, can be used as the deburring media, not only for removing flash but also for smoothing out "orange peel" or flow marks in the mouldings, and radiusing edges.

Fabricated articles in phenolic cast resin, methacrylate, cellulose acetate or nitrate, after machining is completed, can be smoothed, removing cutting marks, scores, etc., in preparation for final polishing. Actual surface removals can be carried out without detracting from the ease of final polishing, and in the same barrel as for self barrelling or deflashing with balls. The barrel is loaded up to 75% of its capacity with chip and work, in the proportion of 2 parts chip to 1 part work, water is added to level with the total mass, detergent added, and the barrel revolved at a reasonably slow speed; 10-15 r.p.m. for a barrel of 32-in. diameter is usually sufficient. Again, the advantages

Fig. 4. Electrical fitting shown before and after being barrel finished

of cleanliness is apparent, as after drying the articles are ready for polishing.

In our factory we process large quantities of mouldings and fabrications daily, and have succeeded in reducing hand operations to a very small percentage indeed of our output. Selection of chip size is important, bearing in mind that the large chip will debur more quickly but will not leave a really smooth surface, whereas the smaller chip will take longer but will give the better surface result. Also, the chip size must be such that it will not lodge in sections of the work, and must separate from the work without trouble. (The question of separation will be dealt with later.) It is also essential that the chip should have been correctly processed before starting operations as if used in their rough state, satisfactory surfaces will not be obtained. The use of an abrasive powder in various grades, mixed with water to form a slurry, or even dry in the barrel, sometimes known as wet and dry-washing, is very well known and does not require further discussion here. Although very efficient in some instances, the work cannot be taken from the barrel in a clean condition, and this can have a serious effect on final polishing.

### Dry Processing

So far, other than wire-mesh barrelling, we have only dealt with wet processes in which water is involved, and so we now come to dry processes for deburring or smoothing operations. A barrel designed for polishing is satisfactory, again keeping to the octagonal shape, the deburring media being a composite ball made in various sizes some of which require periodical dressing with oil or wax and abrasive. The action here is that balls acting as a carrier for the abrasive, work against the outer surfaces of the articles.

Abrasive granules of various types are also available, and serve very useful purposes; these are often supplied together with a coating compound which causes the ground-off material to stick to the granule, leaving the work free from dust.

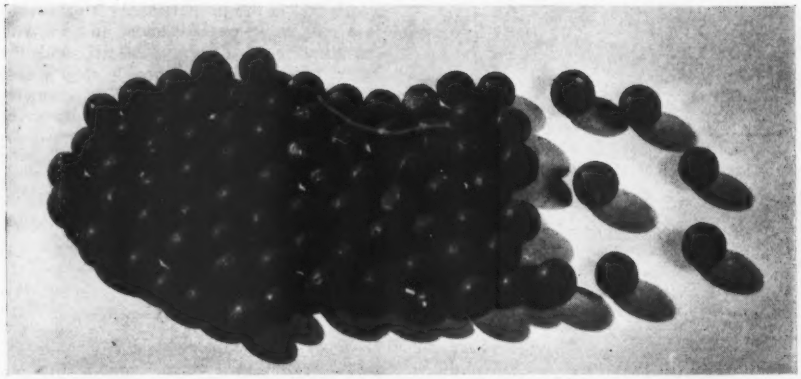


Fig. 5. Abrasive granules used in barrel finishing.

Where composite balls are used, they are very liable to softening if run too fast, especially in hot climates, and it is often advisable to run the barrel fitted with a wire-mesh lid to allow air into the barrel and so keep the contents cool. We now come to the final polishing process, for which again the eight-sided wooden barrel is used, but whereas certain liberties can be taken where barrels for smoothing and deflashing are concerned, a barrel to be used for polishing must be very carefully made. It should be free from internal obstruction, and made in such a way as to admit as little air as possible. The leaves or flats and joints on end plates should be mitred, tongued and grooved. Lids should be tight fitting and end plates well bolted down with possibly coach screws. Also, a polishing barrel should have a solid lid and a wire-mesh lid for each compartment. To obtain the best results, heat must be generated in the barrel during running time and, although this heat is only generated by friction, it is very essential. Again, speed and proportion of load is important, but this can only be decided for each particular job. When new, a barrel will usually require a few loads before results will reach their best.

**Polishing Media**

Many types of media are available for use in polishing barrels. Composite balls consisting of various waxes, plastics chippings, leather cuttings are only some of the materials which are favoured, many users having their own particular method, but I do not think that any of these show better results than the hardwood peg or cube, impregnated with a polishing cream.

Polishing pegs, which are known as pegs because originally shoe pegs for seaboots were used for barrelling, are made in various sizes, a fair standard being ¼-in. square, ¼-in. long, and pointed at one end. The pointed end not only works on the surface of the article but also will enter cornered sections. Various woods are used, among them being oak and beech. The cube also is obtainable in many sizes, such as ¼-in., ⅜-in. and ½-in. square, and owing to its greater weight will sometimes give better results than pegs, depending, of course, upon finish required. I have already explained that a new barrel requires running in or seasoning, so let us presume that we have a new polishing barrel and the media ready at hand. First we select the correct sized peg or cube for our job, taking as an example a telephone earpiece or mouthpiece.

In this case we use ¼-in. cubes, which we load into the barrel until it is loaded up to half its volume. Presuming the barrel compartment to be approximately 16 in. long by 30 in. diameter, this compartment would need about 64 lb. of cubes. We now add the polishing cream. This is sometimes fed into the barrel when hot, and sometimes cold, depending upon the make-up of the cream, although I always prefer a polishing cream fed hot as it helps to increase the heat in the barrel. However, the cream is usually spread over the cubes taking care not to allow it to splash onto the sides of the barrel. The solid lid is fitted, and the barrel run until the cream is thoroughly impregnated into the cubes. This running-in period should usually take ¾ hour, but it must be remembered that this is only necessary when the barrel and cubes are new. Once the barrel has become seasoned, this running-in period is reduced to a few minutes. When running-in is complete and the barrel warmed up, the work can be fed into the barrel. The work must be clean and free from dust, and as we are in this instance, concerned with telephone parts we could load 150 earpieces or mouthpieces into the compartment. The solid lid is fitted and the barrel started on its polishing run.

I have mentioned that speed is important and, of course, speed must be decided in conjunction with the barrel diameter. A polishing barrel of 30-in. diameter would run at 30 r.p.m. for the telephone parts in question and, again, based on a diameter of 30 in. the speed would rarely exceed 35 r.p.m. Of course, the smaller the diameter the faster the speed, as the periphery or outside length is greater on the large barrel. Using a good cream or polish these telephone parts should polish in 4 hours. In most cases, and always where hot polishes are used, the solid lid should be replaced by a wire-mesh lid for the last part of the run. It will be found on inspection that after running for the necessary polishing time the articles are misty and covered with a film, which should be wiped off one example to check that the polish underneath is up to the required standard. By fitting a wire-mesh lid and allowing air into the barrel, the work and media dry out and the articles are left polished and capable of being handled without smearing. One distinct feature of barrel polishing is that if properly carried out, the articles should come from the barrel with a hard, high polish, and with no wax coating to cause marks when handled. Having completed the polishing run, the articles are screened from the cubes or pegs, which are returned to the barrel ready for another run. The procedure is then repeated except that the amount of polish fed into the barrel is very considerably reduced, and the time required to spread the polish by running the barrel before loading the work, need only be a few minutes. Mention has been made of the need to season a new barrel before the best results can be obtained; once this has been achieved, a polishing barrel should be kept running and made to work, so that the timber is kept warm and the joints tight. The pegs or cubes also become well impregnated with polish and so need very little additional polish to keep them going. A barrel-load of cubes will polish many loads of work, only needing two or three ounces of polish per load, and an experienced operator will soon learn that to obtain the best results the polish should be kept as low as possible. Whereas deflashing and smooth finishing processes require considerable variation, the standard polishing barrel will usually handle many different articles both in material and size, without any alteration of the existing equipment.

A few typical examples are shown in Fig. 6.

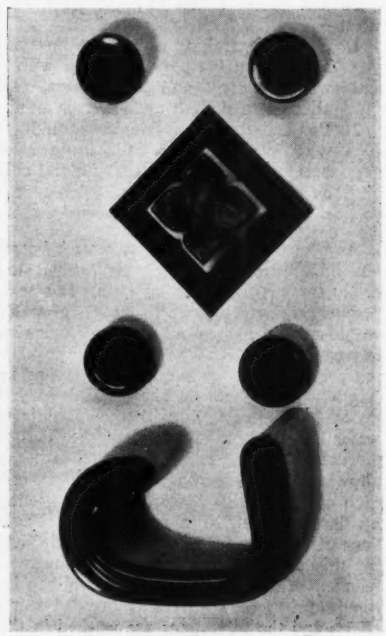
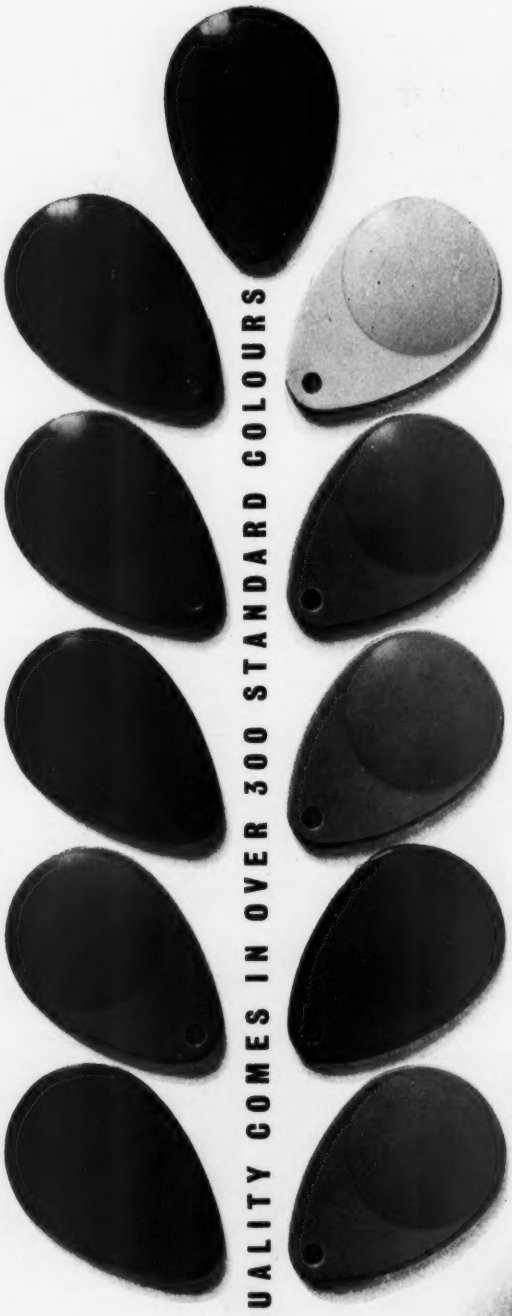


Fig. 6. Typical finished products.

Spectacle frames in cellulose acetate, electrical fittings in urea and phenol, door fittings in phenolic cast resin, umbrella handles in methacrylate, and buttons in phenol and urea are only a few of the articles which can be polished in the polishing barrel, and many manufacturers of casein components have appreciated the better finish obtained with barrel polishing after acid dipping. A few points to note here are: 1. The barrel must be well made with tight points and a generous diameter; 2. Its speed, based on a 30-in. diameter, should be between 25-35 r.p.m.; 3. The barrel and the contents must be kept clean and free from dust; 4. The barrel must generate heat; 5. The barrel



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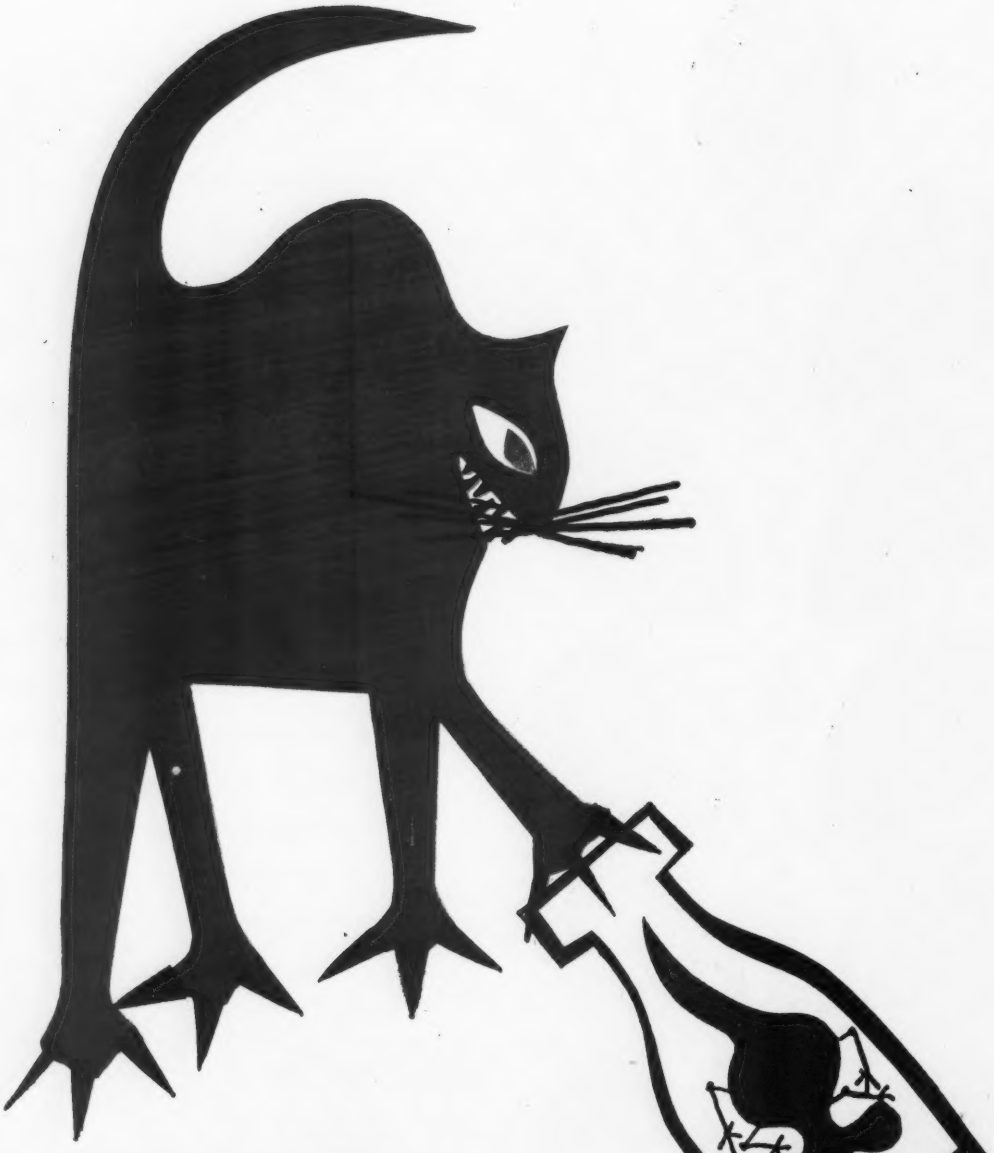

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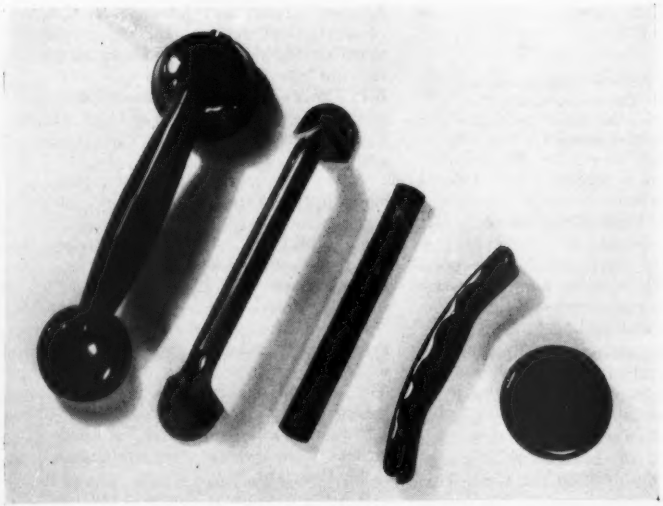


Fig. 7. The quality of finish obtainable with the barrel method is seen clearly in this illustration.

should be installed in a warm, dry atmosphere; 6. Do not overload with polish as it does not always help; 7. Keep the barrel working.

Assuming that the barrel is working well, we can expect to get 25 to 30 loads of work from the barrel, using the same pegs or cubes before it becomes necessary to clean them. Gradually, they will pick up polish until spots are formed on the outside of the peg, which will increase until cleaning is required. Several methods for cleaning are available: for example, soaking in a solvent solution or soaking in caustic soda, both methods being followed by careful drying. Soaking, however, will tend to break up the fibre of the wood and it is not always easy thoroughly to dry the pegs, a condition which is essential for successful barrel polishing. I would advise the use of a trichlorethylene de-greaser as the most satisfactory method. Allow the pegs or cubes to suspend in the vapour, thereby removing the polish from the outside surfaces without disturbing the impregnation. If followed by a run in a fine wire-mesh barrel to remove any adhering dirt, the media can then be returned to the barrel for a further 25 to 30 loads. Many months of wear can be obtained from pegs and cubes by this method.

Finally, we come to the screening of articles from media, and this, of course, applies not only to polishing pegs or cubes but also to metal ball or abrasive chip. Electric rotary or trembling type screens are available, but it should be remembered that too drastic an action will cause damage to heavy or fragile articles. Very often a simple wooden frame fitted with wire mesh, which will hold back the work whilst releasing the media, will give satisfactory results. A stand can be made which will hold the frame already fitted with the correct sized mesh. A container placed underneath will catch the chip which can be guided down through a chute. A screen of this type can be pulled up to the barrel to avoid unnecessary movement.

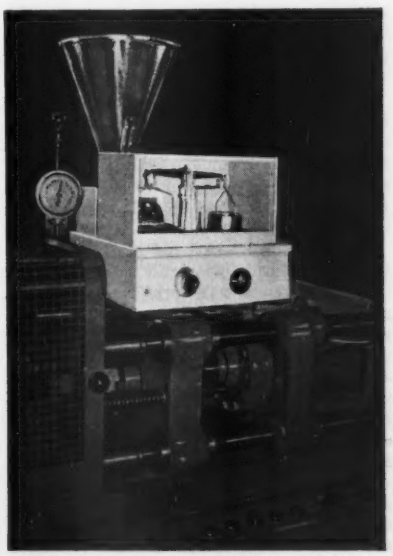
# Precision Electro-Mechanical Dosing Machine for Injection Moulding Plant

A VERY interesting answer to the problem of accurate dosing of injection moulding machines is demonstrated by the use of the Collischan "Praezi-Blitz" electro-automatic weighing and filling machine, as shown in the accompanying illustration.

The hopper having been filled with the plastics material to be used, and the correct weight having been placed on one scale pan, the machine automatically measures the exact amount as required by the injection moulding machine. The weighing of the required quantity enables the mould to be filled completely, and flash to be avoided. The best method of securing the correct weight is to obtain a trial moulding complete with sprue and to place it in the weight pan of the Collischan scale.

This ensures a saving of plastics material as there is no waste and the result is a clean, perfect moulding; and by the avoidance of over-pressure, the life of moulds and machines is prolonged. Small and thin parts especially can be moulded very successfully and without difficulty by the use of this device.

In principle, the machine is very simple. There is no motor, no agitator and no rotating parts and all components of the device are easily accessible. An unskilled operator can master the operation of this machine in a few minutes; and, due to the absence of rotating parts, no oiling or greasing is necessary. The device is automatically operated by the action of the injection moulder and, except for initial adjustment, no further attention is necessary. Parts coming into contact with the plastics material can be cleaned very easily. "Praezi-Blitz" scales are extremely accurate, having an extraordinarily small weight tolerance which increases the high precision of the weighing process. The makers claim an accuracy between ½-1%.



The electro-automatic weighing and filling machine is shown here fitted to the Battenfeld B.S.M. 40S. injection moulding press.

These scales are produced with varying capacities. The smallest model has a range between 3-30 grams (0.11-1.1 oz.), and the largest a range between 150-1,500 grams (5.28-52.8 oz.). The machine has a low current consumption, between 15-300 watts, according to the model used, which means from ½ to 2½ kWh. daily for a normal working day.

The capacity of the weighing scale is so designed that it is large enough to hold any material used in the plastics industry. Output of the "Praezi-Blitz" dosing scale can be adjusted to the speed of the automatic or semi-automatic injection moulder to which it is fitted. An adaptation of this dosing unit can also be used with compression moulding machines.

This ingenious device has been adapted for use with machines in the plastics industry from general-purpose Collischan weighing and filling machines, having a very wide field of application, which includes weighing of small articles such as washers, nuts, bolts, powders, etc., for subsequent packaging.

"Praezi-Blitz" electro-automatic dosing machines are fitted to almost all Battenfeld injection moulding machines now coming into this country. Further information is obtainable from Ed. Brand Ltd., 9 St. Cross Street, Hatton Garden, London, E.C.1.

# PATENT REVIEW

The following abstracts have been made from specifications at the Patent Office, with the permission of the Controller of H.M. Stationery Office. The country of origin for Convention Applications is shown in parentheses. Complete specifications can be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, price 3s. 0d. each (including postage).

**B.P. 739,131. Slide fasteners.** H. Heimann, I. Shur. To: Waldes Koh-I-Noor Inc.

Oppositely disposed fastener elements are moulded in a two-part mould directly on their carrying tapes. They interlock throughout their full depth.

**B.P. 739,152. Multiple welding device for use in the production of filled thermoplastic containers.** L. Rado.

When using welding tools with several welding elements to speed up production the contents of the tube to be divided into containers must be equally distributed. This is achieved by rigidly fixing only that pair of elements nearest the open end of the tube and arranging the other equally spaced pairs on springs so that they can yield when the displaced fluid substance moves backward until these elements also come into operation.

**B.P. 739,184. Nail and other scrubbing brushes.** G. Ingram, Jr.

With a pair of stiff flexible skirts at the ends to form a splash guard.

**B.P. 739,191. Photographic developing apparatus.** W. Eisbein.

The gears for transmitting the revolving movement may be formed of synthetic resin materials lubricated by the liquid flowing down along the inclined rollers thus prolonging their durability.

**B.P. 739,225. Spectacle frame.** G. Millon (France).

Allows changing of lenses.

**B.P. 739,253. Plastic gear member.** To: Ford Motor Co., Ltd. (France).

The moulding ring of metal alloy is produced by pouring the alloy into the annular space of an auxiliary mould around a metal pattern machined under consideration of the probable shrinkage of the plastic material for the gear member (with external helical teeth) to be manufactured. The core is then partly machined away until the teeth can be removed by tapping.

**B.P. 739, 343. Granulating or comminuting machines.** To: J. F. Bas and Co. (France).

The strip of plastic material is fed between rollers to the feed table with adjustable guides and passes to multiple circular cutters. The bundles of ribbons leaving the cutters are cut into nearly cubical grains by knives set askew on their rotating shaft to obviate abrupt action. The cutting parts can be removed as a unit without dismantling the machine frame.

**B.P. 739,436. Drawing sheet plastic.** To: United States Rubber Co. (U.S.A.).

The sheet is temporarily adhered to a cured elastic rubber sheet, then drawn while heating the plastic sheet. Afterwards the laminate is cooled until the plastic sheet is self-supporting whereupon the rubber sheet is stripped off.

**B.P. 739,444. Insulated electric conductor and method of fabricating the same.** To: Standard Telephones and Cables, Ltd. (U.S.A.).

A coating of polytetrafluoroethylene is applied to the wire by dip coating. The wire is then heated in an oxygen enriched atmosphere finally impregnated with a liquid perfluoro-hydrocarbon.

**B.P. 739,467. Collapsible tubes.** To: Unilever, Ltd. (Germany).

A plastics (polyvinyl chloride or polythene) tube surrounded by a metal sheath secured to the tubular body portion by an adhesive or by heat sealing.

**B.P. 739,493. Spectacles.** A. J. Armstrong. To: Willesden Optical Works, Ltd.

The thick edges of lenses for myopic people are grooved. A tongue on the eye rim of the frame enters this groove at least over the top half of the lens while a cord around the lens holds it in the rim. This arrangement, an inversion of the usual practice, eliminates reflections along the edges of the lens.

**B.P. 739,523. Thermoplastic compositions.** To: United States Rubber Co. (U.S.A.).

Blends of unplasticized vinyl chloride polymers with small amounts of a copolymer of a conjugated diolefin and a dialkyl fumarate. The compositions are rigid but non-brittle.

**B.P. 739,524. Thermoplastic compositions.** To: United States Rubber Co. (U.S.A.).

Similar compositions as in B.P. 739,523 but with a vinyl-pyridine instead of a dialkyl fumarate.

**B.P. 739,613. Plate separators for electric accumulators.** To: Cie Générale d'Electricité (France).

Perforated flat sheets with ribs on one of the faces and with supporting and positioning studs projecting laterally for suspending and centring the conductive plates. Other lateral bosses secure the separator in the accumulator box while the separator rests with a foot on the bottom part of the box. It may be moulded from ebonite, polystyrene, vinyl chloride, polyethylene, or the like resistant to acid electrolytes.

**B.P. 739,626. Liquid dispensing containers.** To: Foxboro Co. (U.S.A.).

A long flexible dispensing spout is pushed with its end into a recess in the closure unit to seal off the interior of the squeezable (translucent polyethylene) container when not in use.

**B.P. 739,668. Method of making reinforced tubing.** W. E. Meissner.

A continuously extruded plastics strip is wrapped helically with contacting or overlapping edges and a preformed (plastics mono-fil) helical element is guided into position along the contacting, or between the overlapping, edges. Edges and element are then caused to coalesce and the assembly is set.

**B.P. 739,709. Treatment of polymeric substances.** A. Charlesby. To: U.K. Atomic Energy Authority.

Substances of high molecular weight characterized by a chain structure (polythene, nylon) are cold drawn to bring about orientation of the molecules, then subjected to ionizing radiations to set the orientation wholly or in part.

**B.P. 739,751. Fibrous product suitable for filtering.** To: Paper Patents Co. (U.S.A.).

Impregnated with a reaction product of a carbamide-aldehyde resin and starch for filtering petroleum products.

**B.P. 739,766. Vinyl chloride polymer compositions.** E. L. Weinberg, C. K. Banks, E. W. Johnson, C. R. Gloskey. To: Metal and Thermit Corp.

Antimony mercaptide compounds as stabilizing agents for polyvinyl chloride compositions.

**B.P. 739,786. Tubular material for banding bottle necks.** S. T. Carter. To: Geo. J. Meyer Mfg. Co.

The material, which may be a cellulose derivative having a very high coefficient of shrinkage in drying, is formed by extrusion as a seamless tube with a wall thickness of 0.002 to 0.005 inches. When set, the tube is folded so as to form a two-ply flat ribbon.

**B.P. 739,801. Production of decorated articles from thermosetting synthetic resins.** L. H. Hayward.

A design is applied in printing ink to a piece of absorbent paper which is bonded to a thin backing. The wafer of paper and backing is impregnated with a thermosetting resin, then applied to a compression moulded article before curing has hardened the surface, so that subsequent compression and curing embeds the wafer in the article.

**B.P. 739,802. Production of decorated articles by moulding from thermosetting synthetic resins.** L. H. Hayward.

The wafer (see B.P. 739,801) is mechanically guided to engage the article in correct location. As resins, formaldehyde types (phenol, urea, melamine, thio-urea) are used.

**B.P. 739,803. Moulding of decorated articles from thermosetting resins.** Fairey Aviation Co., Ltd., J. M. Griffith, R. Harvie.

Concerns the application of the wafer (see B.P. 739,802) to the moulding by means of a suction head with guide surfaces.

**B.P. 739,836. Method of printing on transparent material.** To: Transart Aktiebolaget (Sweden).

A sheet of supporting material is fed to the printing machine together with the sheets to be printed.

**B.P. 739,852. Projection screens.** M. Schumann (Germany).

Grooved sheets of thermoplastic material are joined at their superimposed margins by welding so that the grooves (and/or ridges) extend across the welding seam. The welded plastics (polyvinyl base) sheets may be metallically coated.

**B.P. 739,918. Packaging tooth-cleaning articles.** P. Legendre.

A case constituting a cup and a container slidable therein for tooth-brush and paste tube wrapped in a cellulose towel.

**B.P. 739,925. Packaging.** To: Celanese Corp of America (U.S.A.).

Arrangement to eliminate wrinkles and distortions when heat sealing layers of thermoplastic wrapping material to one another.

**B.P. 739,943. Injection moulding machines.** E. Eynard (France).

Between injection cylinder and plunger is a free auxiliary tubular piston with an elongated lateral aperture registering with the feeding aperture of the cylinder.

**B.P. 739,988. Process of preparing artificial dentures.** To: Farbenfabriken Bayer A.G. (Germany).

Dentures with soft cushion linings can be prepared in a technically simple process by utilizing for the lining a soft and non-hardening copolymer of an acrylate or methacrylate with butadiene.

**B.P. 739,990. Primary galvanic battery and method of making same.** J. L. S. Daley, D. B. Cameron. To: Union Carbide and Carbon Corp. (U.S.A.).

A stack of trays each containing cell elements with a moisture-proof seal between the trays. The trays are formed from a strained tubular band of a thermoplastic synthetic organic resin (e.g., a semi-rigid copolymer of vinyl chloride and vinyl acetate).

**B.P. 740,012 Artificial sponges or absorbent pads.** C. S. J. Summerlin. To: Plysu Products, Ltd.

Made from viscose material. One face is covered with a film of polyvinyl chloride providing a rubbery backing.

**B.P. 740,035. Razor blade magazine.** G. A. Ljungberg (Sweden).

A base with a guide for the central longitudinal slots of the blades and a cover having an opening for a finger to remove the topmost blade through a front discharge slot.

**B.P. 740,042. Detachable weather shield for use on windows of motor vehicles.** W. P. Walcott (Australia).

A Perspex plate is clamped to the channelling of the car door leaving a clearance to permit the driver to give signals. The lower edge of the plate is bent outwardly as a rain deflector.

**B.P. 740,054. Process for pulverizing polyethylene.** To: Montecatini Soc. Gen. per L'Industria Mineraria e Chimica (Italy).

When polyethylene is subjected, at a temperature between 50° C. and a temperature lower than its melting point, to a mechanical reducing force the polyethylene is readily converted to a fine powder.

**B.P. 740,070. Turning attachment for tiles or playing elements on game boards.** M. Keim (U.S.A.).

**B.P. 740,186. Electronic seaming machines.** To: Singer Mfg. Co. (U.S.A.).

A radio-frequency oscillator furnishes the energy for bonding diathermic sheet material. The switch is actuated by the treadle controlling clutch and brake in timed relation with the feed of the material.

**B.P. 740,188. Thermoplastic resin-rubber compositions.** To: United States Rubber Co. (U.S.A.).

A blend of cross-linked polystyrene resin, resinous styrene-butadiene copolymer and rubbery butadiene-styrene copolymer of high-impact resistance, improved processing properties and high resistance to ultra-violet light.

**B.P. 740,189. Stopper for bottles.** G. Lanfranconi, E. Crugnola, I.N.G.E. Industria Nazionale Guarnizioni Ermetiche Soc. in Nome Collectivo di Lanfranconi and Crugnola (Italy).

A combined bulb and cap with a polyethylene pipette.

**B.P. 740,203. Vinyl resin compositions.** To: Union Carbide and Carbon Corp. (U.S.A.).

The addition of ethyl ortho-formate or ethyl ortho-silicate (0.5 to 10% by weight) imparts improved resistance to decomposition by heat.

**B.P. 740,204. Coloured pictures.** V. Michel. To: Les Fils de Victor Michel.

The coloured picture is printed separately on two sheets of transparent plastic material (Rhodialine; Cellophane; Clarifoil; Kodatrace). The two images are superposed in register and made light diffusing.

**B.P. 740,209. Darts or like projectiles.** E. Haecker.

Made of moulded parts with metal points and guiding fins for feathers.

**B.P. 740,242. Synthetic resin moulded articles and their manufacture.** To: Holzwerke Zapfendorf G.m.b.H. (Germany).

Hard moulded articles of wood chips and hardened synthetic resins 3 to 12 mm. thick. The chips are impregnated, at least partially, so that the resin content is between 5 and 20% and the specific gravity greater than 0.8.

**B.P. 740,288. Cap and cover unit for use with an aerosol type of container.** To: Dill Mfg. Co. (U.S.A.).

A cover, a channelled operating part with a discharge orifice, a cap with a peripheral skirt over the cover. All parts may be moulded from plastics.

**B.P. 740,323. Method of manufacturing mould elements.** R. E. Moren, H. V. Villner (Sweden).

Use of additional binders selected from natural or synthetic resins (melamine, phenol formaldehyde resins).

**B.P. 740,346. Modification of synthetic resins and compositions containing them.** To: Chemische Werke Albert (Germany).

Phenol-aldehyde resins, epoxide resins, alkyl resins are reacted with 4-10% carbonyls of cobalt, nickel, iron. Films, casting resins, extrusion masses, lacquers may be made harder, more glossy, less sticky.

**B.P. 740,382. Hone for razor blades.** J. McD. Downie.

Two plies of plastic, one at least is transparent, and a ply of paper sandwiched between them bearing advertising matter.

**B.P. 740,393. Stretching of film of synthetic linear organic polymeric material.** To: E. I. Du Pont de Nemours and Co. (U.S.A.).

**B.P. 740,412. Handbags and other flexible containers.** J. Schofield.

An edge reinforcement is obtained through a cane, wire or other resilient member enclosed in an extruded beading of polyvinyl chloride having a continuous longitudinal fin for sewing it between parts of the bag.

**B.P. 740,438. Battery separator and method of making same.** To: United States Rubber Co. (U.S.A.).

A fibrous sheet (wood pulp; cotton linters) is impregnated with a mixture of a thermosetting phenolformaldehyde resin and a pine wood resin.

**B.P. 740,441. Method of welding polyethylene and like plastic materials.** Ciba Laboratories, Ltd., J. G. Bedford.

The marginal portions of laminae of polyethylene are placed between temperature controlled platens with a space between the inner surfaces. Radiant heat is directed downwards and a molten bead built up on each portion until the beads bridge the space between the marginal portions. The rate of cooling is then so controlled that the region of fusion extends laterally before solidification.

**B.P. 740,458. Manufacture of tubular articles of thermoplastic material.** E. H. A. Lampard, B. Shaw. To: British Cellanese, Ltd.

Heat fluidized material extruded as a tube is cooled to a temperature at which it is no longer plastic while drawing it away from the extrusion point. The cross-section is controlled by "shaping rolls" which form an aperture between them, through which the tube is drawn so long as the material is still soft enough to be shaped but already hard enough to retain the shape.

**B.P. 740,540. Flexible laminated sheet material suitable for use as a wrapping material.** Winn and Coales, Ltd., F. B. Coales.

To prevent corrosion of pipes, tanks, cable sheathings through atmospheric, chemical, electrical influences. Glass fibres are impregnated and embedded in a permanently plastic medium on a backing consisting of a continuous film of Alkathene.

**B.P. 740,576. Production of aluminium-containing polyester resins.** To: Chemische Werke Albert (Germany).

**B.P. 740,593. Resinous thermoset compositions and articles produced therefrom.** To: Westinghouse Electric International Co. (U.S.A.).

An insulated conductor wrapped with glass fibres, which are then impregnated with a fluid polymer prepared from a solvent-free, partially condensed arylene-siloxane polymer.

**B.P. 740,598. Polystyrene of improved impact strength.** To: Monsanto Chemical Co. (U.S.A.).

For use as moulding powder made from butadiene-styrene copolymers.

**B.P. 740,611. Process for producing coloured layers of polyvinyl materials.** To: Farbwerke Hoechst A.G. (Germany).

Water-insoluble or sparingly water-soluble azo-dyestuffs are formed from their components in thin coating layers produced from aqueous dispersions of polyvinyl compounds.

**B.P. 740,633. Corset bones.** T. A. Rose. To: Bondor Ltd.

A stiffener made from an extruded strip of plastic material (Nylon; Terylene).

**B.P. 740,720. Chemical products.** To: E. I. Du Pont de Nemours and Co. (U.S.A.).

Relates to polyamine copolymers having an amino nitrogen content of 0.3 to 10%. As coatings, impregnating compositions, adhesives, binders of outstanding stability of colour.

**B.P. 740,732. Flexible tubing.** Compoflex Co., Ltd., J. Moseley.

Two or more superposed helically wound layers of plasticized p.v.c. bonded without adhesive by pressure under steam heat. The tubing may be corrugated by winding it over a mandrel and wrapping it with rubberized cloth and a wire helix. Cloth and wire are finally removed.

**B.P. 740,811. Heat-sealing of thermoplastic film.** W. E. F. Gates. To: I.C.I. Ltd.

The tendency of a polythene film to stick to the heat-sealing member cannot be overcome completely by interposing a film of polytetrafluoroethylene or impregnated glass cloth or the use of silicon resin. By preventing the film from rising with the heat-sealing member through water-cooled securing members close to the sealing region to be withdrawn after withdrawal of the heat-sealing member, the speed of sealing, e.g., polythene bags, can be greatly increased.

**B.P. 740,853. Method of preparing moulds to produce crackle and other surface finishes on moulded plastic articles.** C. K. Swartz. To: Consolidated Molded Products Corp.

Metallic parts of business machines could be made much more cheaply of plastics if the application of the conventional "texture" were not so expensive. A mould with a properly textured surface is obtained by preparing a model with an electrically conductive surface, then electroplating the surface to form a mould shell having a complementary textured surface.

**B.P. 740,855. Methods of manufacturing battery separators and the like.** H. F. Dague (U.S.A.).

The principal material is a thermoplastic resin (polystyrene or acrylic resins) in the form of globular particles or beads.

**B.P. 740,857. Process for the manufacture of lamp shades, luminous and advertising signs, embossed articles and the like from synthetic materials.** P. Stebler (Germany).

Made of polyester of ethoxylin resins. Inlays are introduced into a mould between glass fleece or fabrics, then the resin is filled in and allowed to harden.

**B.P. 740,899. Polymeric substances.** A. Charlesby. To: United Kingdom Atomic Energy Authority.

If a polymeric substance (polythene) is subjected to ionizing radiation close to or above its melting point the pliability and elasticity is greatly increased.

**B.P. 740,923. Phenolic resinous compositions.** To: General Electric Co. (U.S.A.).

Addition of monomeric epoxide reduces tendency to blister.

**B.P. 740,933. Method of riveting together two pieces of material one at least of which consists of nylon or like material.** D. W. Ripper. To: Joseph Lucas (Industries), Ltd.

The tendency for the connection to become loose has been overcome by forming an annular recess in the nylon around the rivet and squeezing the pieces to be connected between a pair of plates of which the one under the nylon has a convex protuberance so as to indent the nylon piece under the rivet.

**B.P. 740,947. Polyvinyl chloride for use in plastisols.** To: United States Rubber Co. (U.S.A.).

**B.P. 740,971. Guiding conduits for flexible metallic control cables.** J. S. Bentley. To: Teleflex Products, Ltd.

Formed from an extruded or moulded elongated body of plastic material.

**B.P. 740,988. Containers for curved suture needles.** G. S. Shaw.

A cylindrical tube section closed at one end and merging at its other end into a flat or oval section to receive the needle.

**B.P. 740,994. Plastic products.** J. Allan, D. W. Browne, H. Samuel. To: British Celanese, Ltd.

Variegated colour effects can be obtained by extruding two differently coloured materials under conditions in which the one becomes fluid and forms a matrix in which the other is distributed.

**B.P. 741,001. Plastic tile and method of making the same.** To: Armstrong Cork Co. (U.S.A.).

Outstanding floor tiles are obtained from a combination of certain vinyl resins with certain coumarone resins and glycol phthalate resins used in certain proportions as a binder with filler material.

**B.P. 741,022. Plastic materials.** R. C. Gillham, H. B. Kingsley. To: Monsanto Chemicals, Ltd.

A high-quality pearl lustre effect can be obtained in a polystyrene material if a certain relationship exists between the molecular weight of the polystyrene and that of polyvinyl acetate incorporated therewith.

**B.P. 741,029. Garden cloches.** F. F. Jaray.

A rigid frame with a number of flexible (polyvinyl chloride; polystyrene; polymethacrylate) sheets with edge reinforcements. To provide ventilation, a stick may be inserted between overlapping edges to hold them resiliently apart.

**B.P. 741,040. Process and apparatus for the manufacture of cup-, box- or dish-like hollow bodies from thermoplastic foil.** To: Kunst im Druck Obpacher A.G. (Germany).

Equal lengths of polyvinyl chloride foil (0.01 to 0.5 mm. thick) are fed into a hollow mould where they are urged against a heated portion by air pressure. The softened foil is then urged, by air pressure from the heated side, against a cold portion of the mould where it hardens adopting the shape of this mould portion.

**B.P. 741,133. Gas expanded material and process for preparing the same.** Sorbo Ltd., M. W. Davies, M. M. Heywood.

Urea hydrogen peroxide mixed with a fatty acid is added as a blowing agent to polyvinyl chloride resin and tricresyl phosphate.

**B.P. 741,163. Method of improving the adhesion of synthetic sausage casings to the filling.** To: Wolff and Co. Kom. Ges. a.A. (Germany).

Refers to casings produced from alginates.

**B.P. 741,186. Circular and other saws.** C. E. Giles. To: Elsworth Ltd.

A triangular cutting tip of hard metal (tungsten carbide) is applied as a fusion deposit by welding to the steel body. Specially shaped teeth are recommended for sawing plastics and plastic bonded laminates.

**B.P. 741,215. Machine for producing shell moulds.** To: Aktiebolaget Westin and Backlund (Norway).

The pattern unit is moved face downwardly continuously through preheater and shell (sand and resin binder) forming device, curing furnace and parting device.

**B.P. 741,230. Fluid containers.** P. J. Schofield. To: I.C.I. Ltd.

Formed from a synthetic fibre material and one or more layers of an organic polyisocyanate-modified alkyd resin composition. For aircraft fuel tanks.

**B.P. 741,231. Soap stands.** R. A. Dearden.

A ring with feet and teeth opposite the feet to be forced into the soap.

**B.P. 741,240. Fluid containers.** P. J. Schofield. To: I.C.I. Ltd.

**B.P. 741,241. Design forming and attaching method.** A. W. Franklin.

A metal sheet (copper) coated on one side with a heat and pressure sensitive adhesive simultaneously cut out and cemented to a backing plate ("Masonite"; "Bakelite").

**B.P. 741,295. Apparatus for manufacturing film or sheet material.** R. B. Kenyon. To: Kodak Ltd. (U.S.A.).

The film forming composition is delivered from a hopper between blades to a moving casting surface in an airtight enclosure.

**B.P. 741,363. Electric battery separators and method of preparation thereof.** H. D. Wilson, J. H. Quick. To: Auto-Lite Battery Corp.

A thin sheet of matted cellulose fibres impregnated with a dispersion in water of phenol-formaldehyde resin.

**B.P. 741,396. Soap holder and applicator.** H. Schmid (Switzerland).

Of polyethylene or polyvinyl plastics formed with sharp-edged perforations to attain a friction and massage effect.

# German Thickness Gauge

*Data on a German thickness gauge which uses the beta ray absorption principle in its construction.*

With the rapid development in the manufacture of sheet materials, from the fairly thick grades such as styrene for vacuum forming, to thin foils for packaging in polythene, it has become necessary to make use of continually more accurate equipment for measuring and control. One of the most notable contributions to this aspect of technology has been the introduction of the beta ray thickness gauge for the measurement of weight per unit area, either in grammes per sq. metre or oz. per sq. yard, or thickness in mm. The system is based on the principle of the absorption of rays emitted by radio-active isotopes so that at constant density, the thickness of material to be measured is proportional to the weight per unit area, i.e.

$$\frac{\text{Weight per unit area}}{\text{thickness}} = \text{density.}$$

The advantages of this accurate no-contact measurement are obvious; valuable raw materials are saved, production is accelerated and simplified and the quality of the product is improved.

The principle of measurement is the use of a beta ray source having a long half life being arranged on one side of the material to be measured. On the other side an ionization chamber receives the rays that pass through the material. After amplification the chamber current is used to indicate the weight per unit area by means of a moving coil instrument and a chart recorder. Depending upon the thickness of material to be measured, radio-active materials of varying penetrating power are employed, typical being thallium 204 which will measure plastics films of a density of up to 1.5 up to a maximum thickness of 1 mm. The half life of thallium is 3½ years.

We are indebted to the English agents of Frieseke and Hoepfner, The International Corporation, Ltd., 1 Cornwall Road, London, S.E.1, for the data incorporated in this note.

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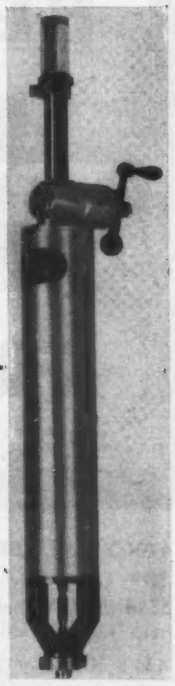
Keep you straight . . .

*(At this point the Managing Director curled up on the ground and passed into a deep slumber).*



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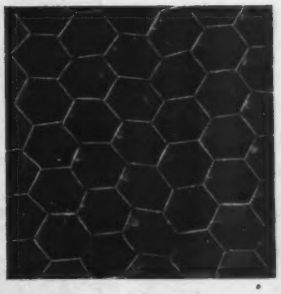

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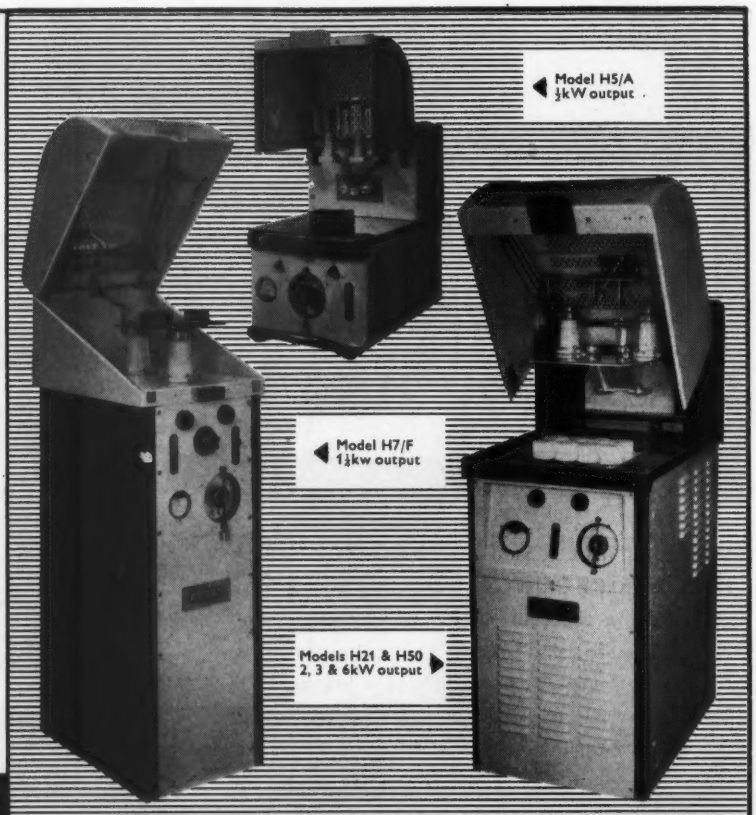
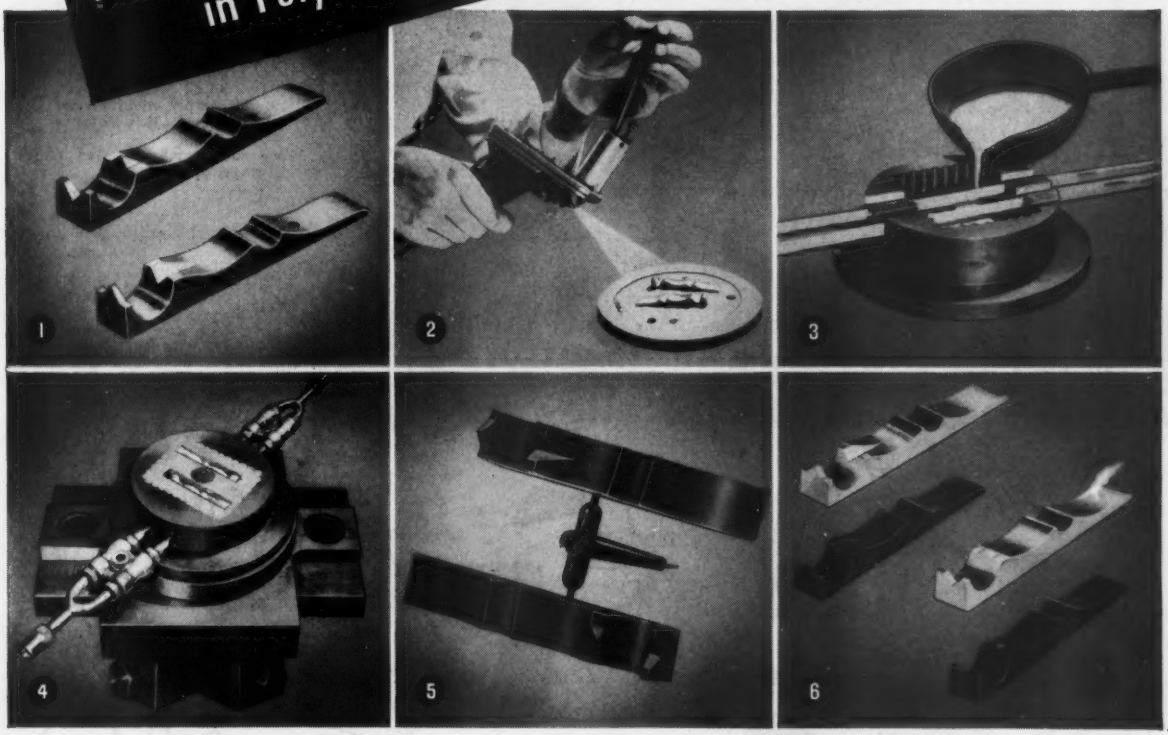


# For the First Time!

By courtesy of Messrs. S. Smith & Sons (England) Limited, we illustrate manufacture of injection mould for production in Polystyrene in a total time of 33 hours and a fraction of cost of machining.




1. Aluminium master pattern.
2. Spraying pattern with Cerrocast.
3. Pouring molten Cerrocast to back sprayed shell and embed water cooling tubes.
4. Complete mould. 5. Typical shot.
6. Comparison of patterns and mouldings.

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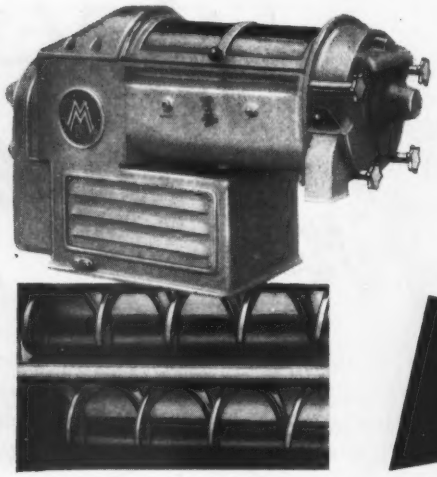

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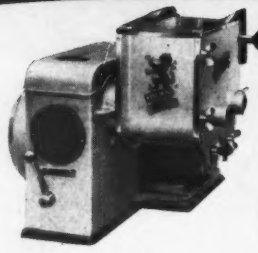

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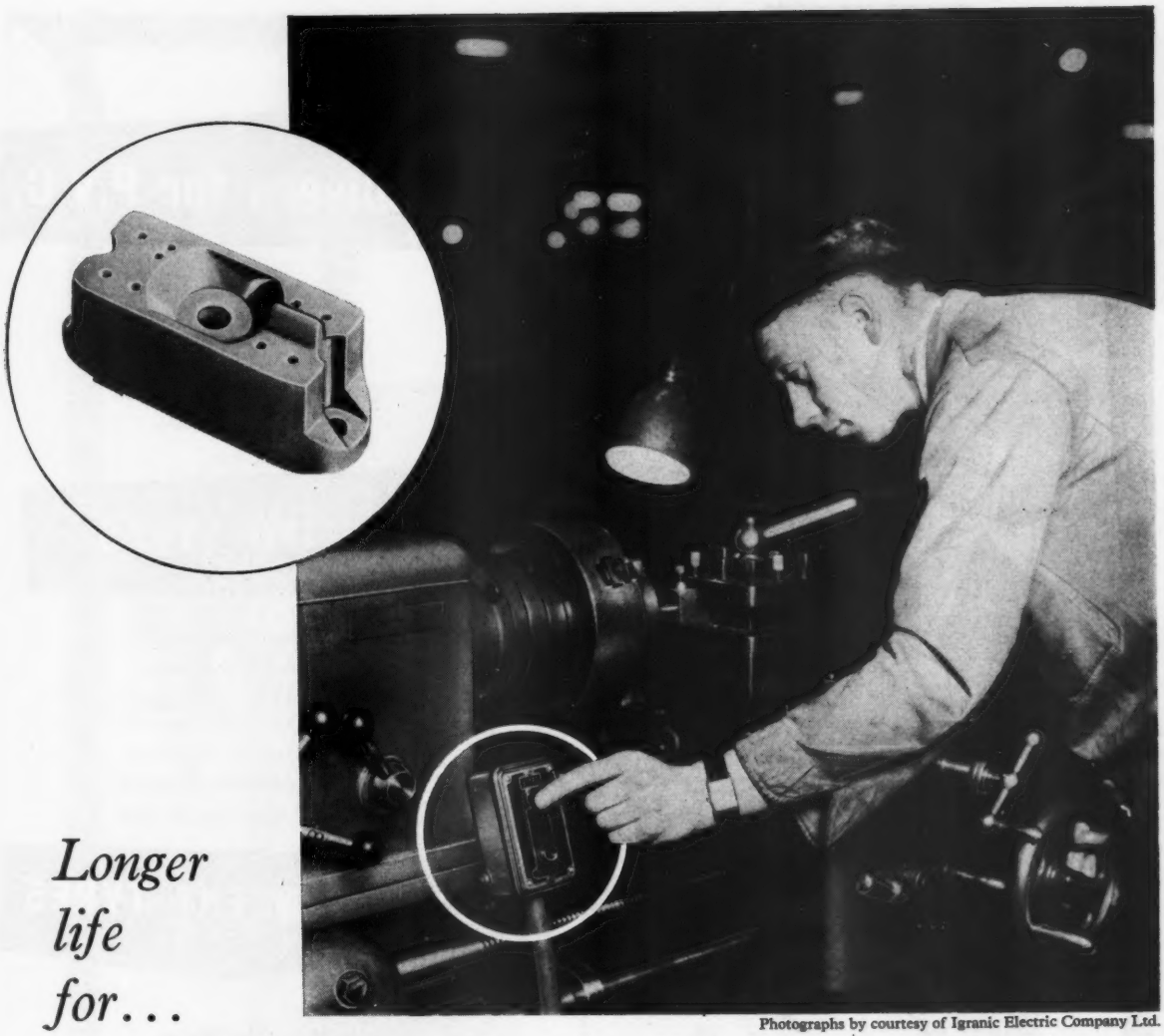

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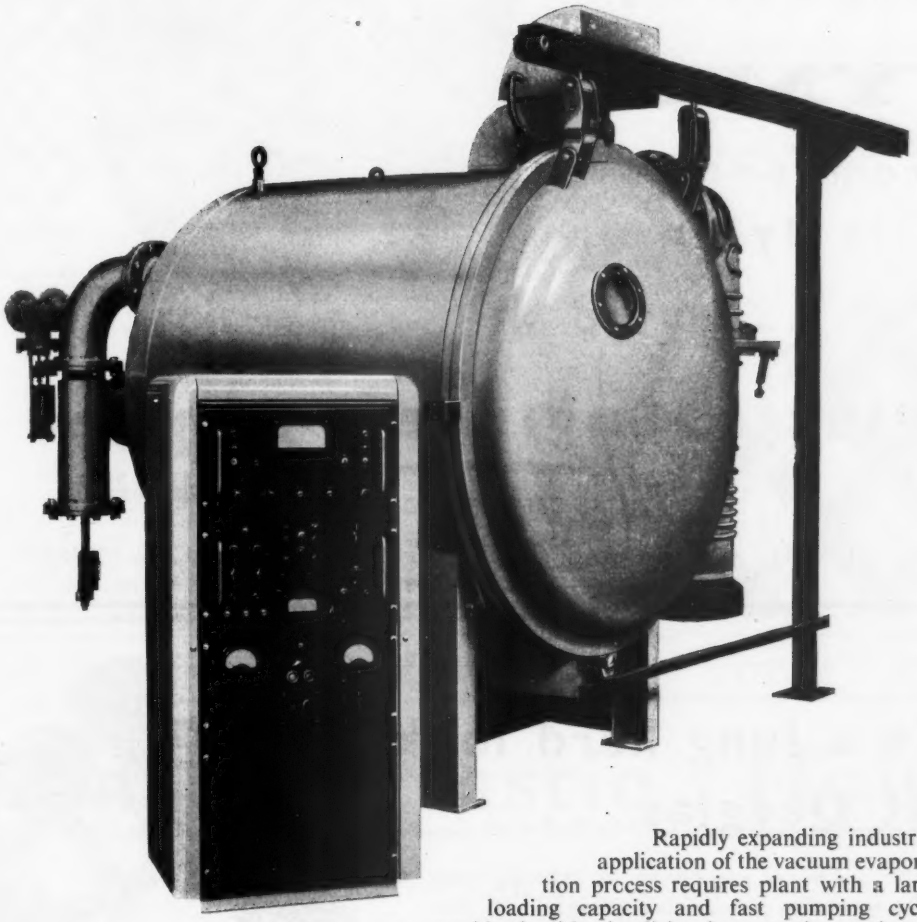

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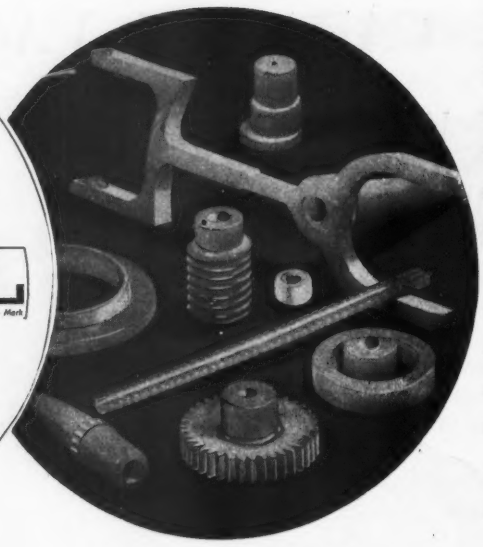

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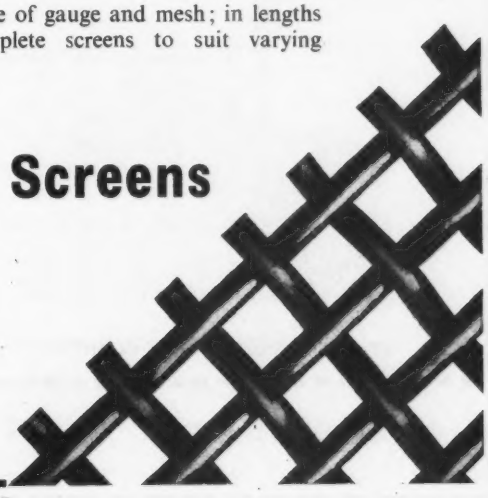

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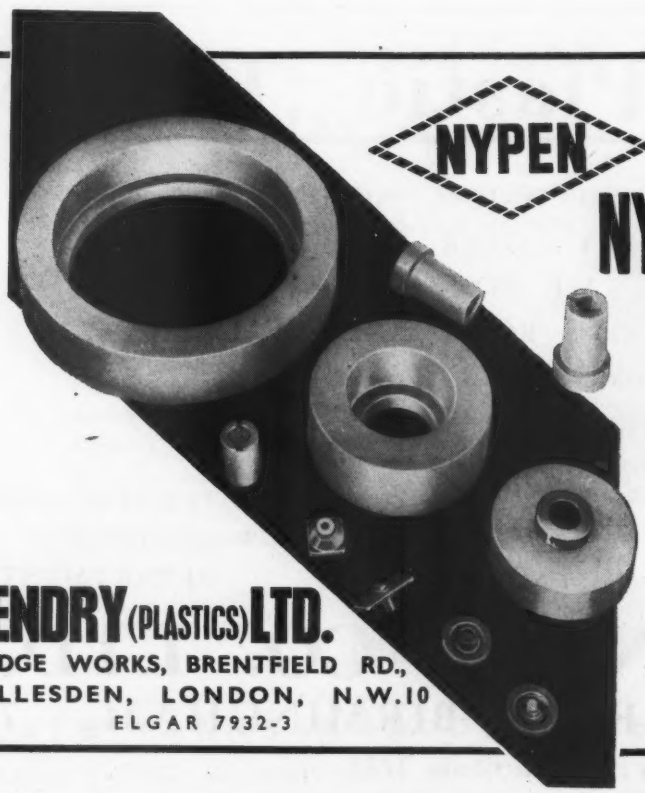

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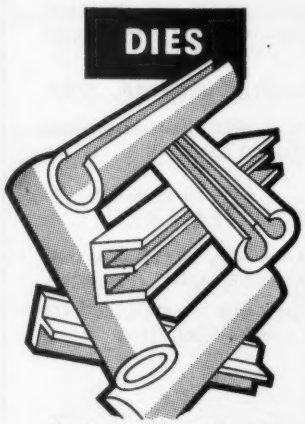

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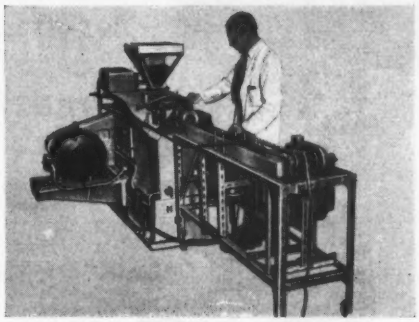

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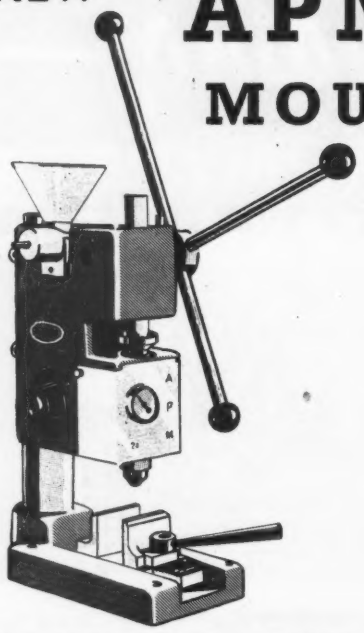

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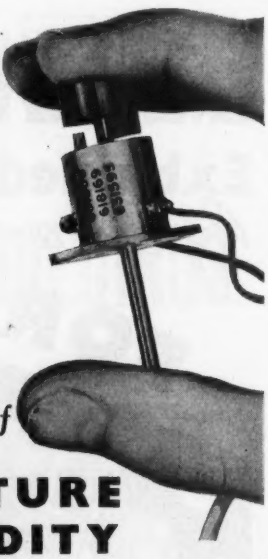

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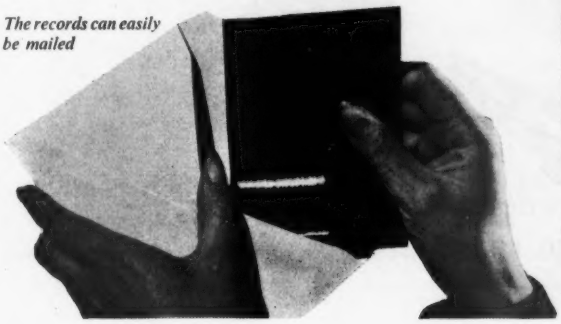

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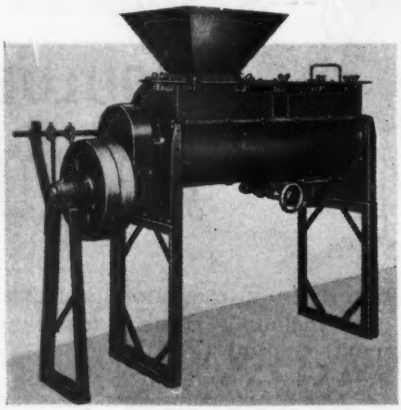

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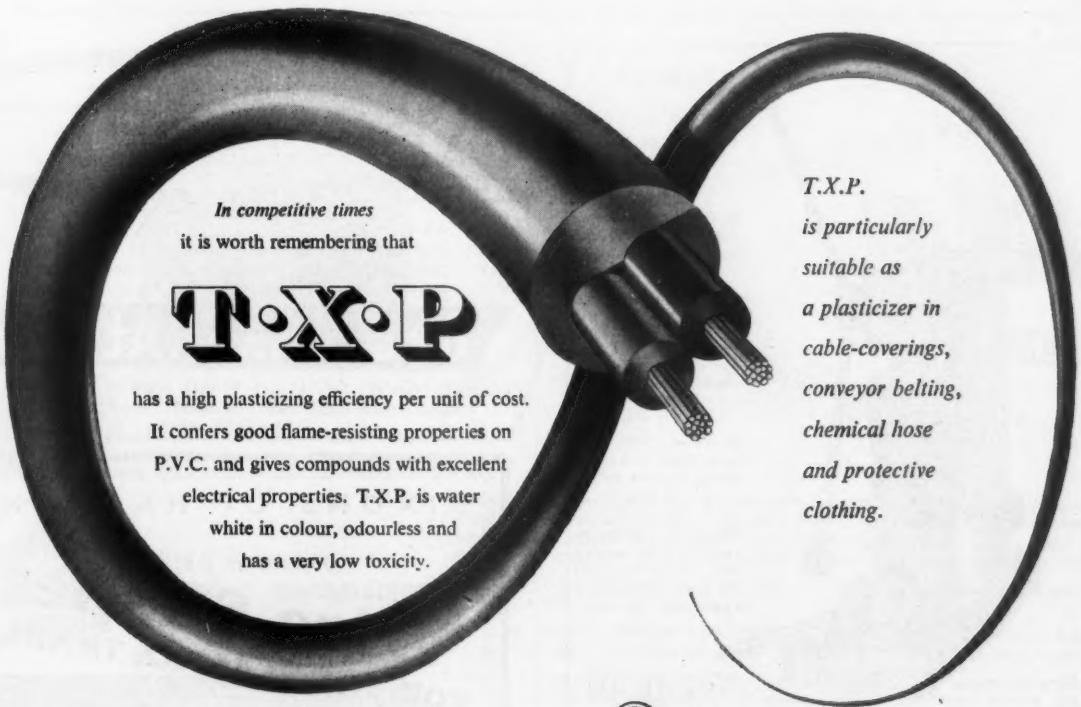
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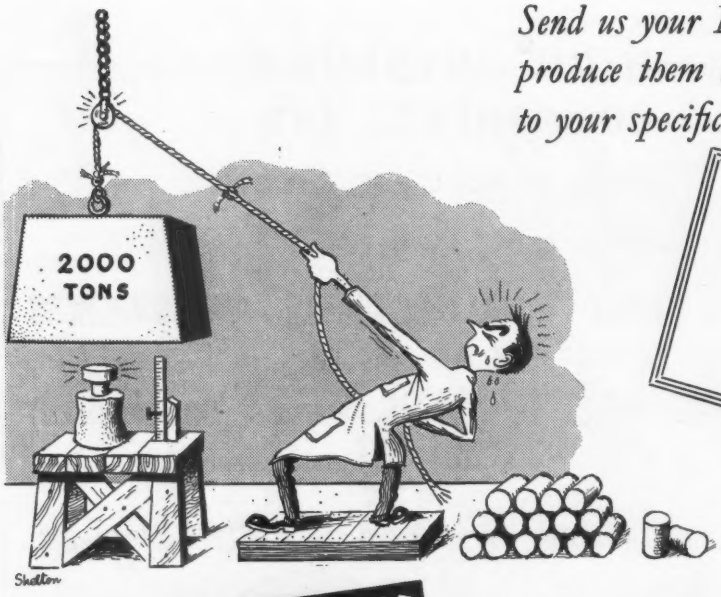


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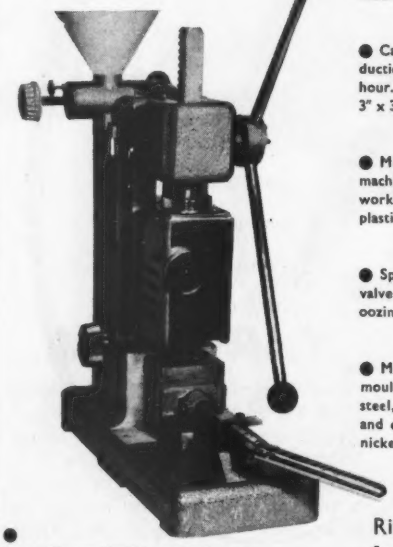

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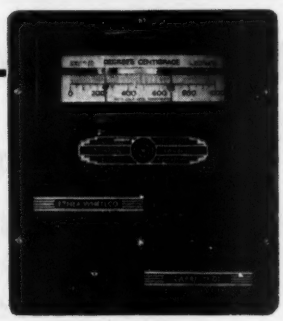

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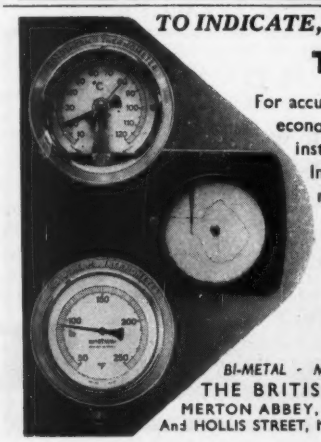

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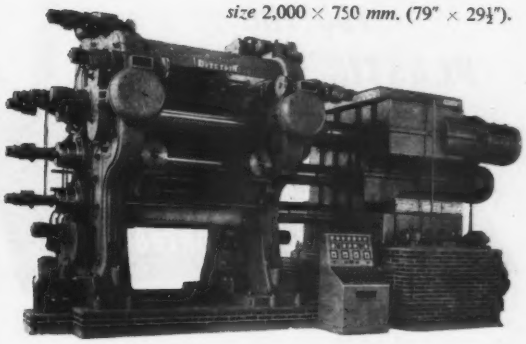

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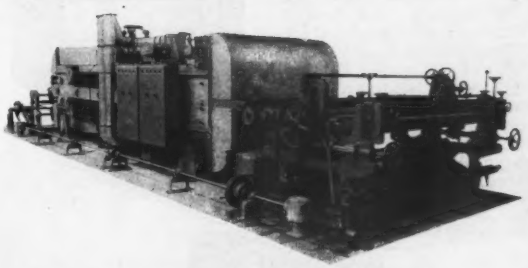

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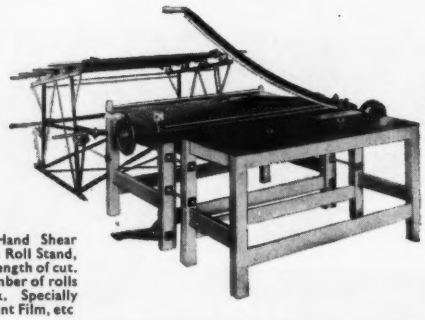

Model No. 1 Hand Shear Cutting Machine, 30", 43", 54" and 60" length of cut.

Shear Machines, Bench and Floor Models. From 3" to 114" length of cut. Many other Machines for your Trade.

Model No. 1 R.F. Hand Shear Cutting Machine with Roll Stand, 30", 43", 54" and 60" length of cut. Roll Stand for any number of rolls up to maximum of six. Specially suitable for Transparent Film, etc

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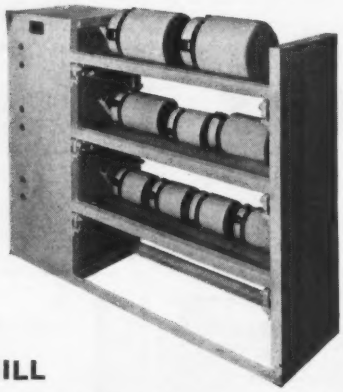

**TRIPLE ROLL MILL**

Pascall Triple Roll Mills are ideal for experimental work, sampling, production testing and small-scale production.

Available with either steel or porcelain rolls and with hollow steel rolls for heating or cooling. The model shown here is the No. 3 size with rolls 6" dia. x 12" long.

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*For full details write or telephone Paddington 7236 for List RM 3701.*

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BIRMINGHAM · 4
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*Wanted*

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We are cash buyers of merchandise of every description. Also Clearance Stocks, Discontinued Lines, Surplus and Redundant Stocks. **BOTTLES, Jars, Screw Caps, Cartons, and other Packaging Materials.** In fact, goods of all kinds can be disposed of through us without delay, on the most favourable terms, and without trouble.

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**B.L.C.**
**(EXPORTS) LIMITED**

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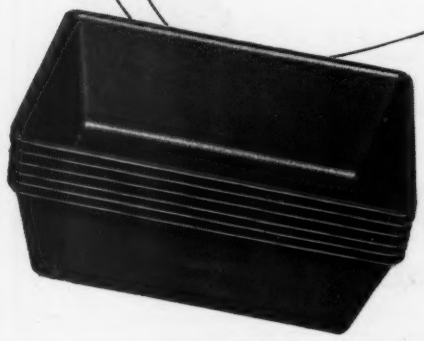
*for* **ALL THERMOPLASTICS**

CELLULOSE ACETATE · BUTYRATE
POLYSTYRENE · P.V.C., etc., etc.

*You can make it lighter and **stronger** in*

# MICOR GLASS REINFORCED PLASTIC



Whether your product is an everyday article like a tray or a complicated moulding to be used as an aircraft part or car accessory, it will be lighter and stronger than metal — weight for weight — if you mould it in MICOR glass reinforced plastic. It will also be corrosion-resistant and dimensionally stable under extremes of heat or cold. A technical representative will be pleased to call on request to discuss your requirements.

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| PHENOL: | 39.5/41°C |
| CRESOLS: | 60/64% meta content<br>ortho, pure grade A |
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*Enquiries to :-*

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*Telephone: Sheffield 63025 Telegrams: 'Unichem' Sheffield*

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(Regd. Trade Mark)

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| GUMS | ADHESIVES |
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*Scope of Products successfully handled practically unlimited*

**MAXIMUM OUTPUT at LOWEST COST**

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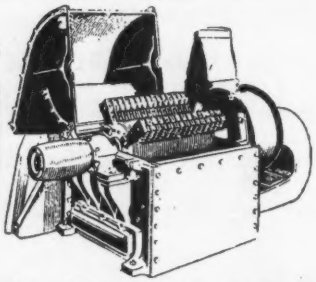

*Demonstrations are willingly given on your own material.*

*By Appointment.*

*Write for Catalogue P*

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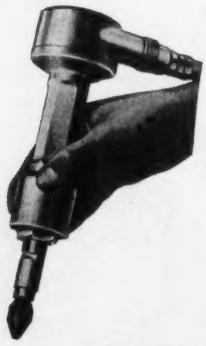
## HAND GRINDERS FOR YOUR MOULDS

**AJAX JUNIOR**

**Weighs only 8 oz. Speed approx. 90,000 R.P.M. For Grindstones ¼" to ½" dia. Sturdy Spindle Collet bored for ⅛" dia. shanks. Air Pressure required 50-100 lbs./sq. in.**

Leaflets P2 and P3 on request.

*Please state Air Pressure when ordering.*



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**Powerful, yet easily handled. Speed approx. 50,000 R.P.M. For Grindstones ⅛" to ½" dia. Collet bored for 6 mm. or ¼" dia. shanks. Air Pressure required 50-100 lbs./sq. in.**

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## A PLASTIC POTENTIAL
## HIGHEST COMMERCIAL QUALITY

*For Samples and Quotations*

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GRANULATION and reprocessing plant available for:— Nylon, Cellulose Acetate, Polystyrene, Polythene and other Thermoplastic scrap. Materials ground to customers' requirements.

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MADE BY
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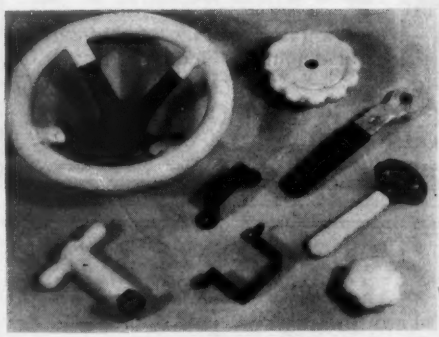
WE ARE PROUD OF OUR REPUTATION FOR MAINTAINING DELIVERY SCHEDULES

# PLASTIC COATING

**TO THE TRADE**

**POLYTHENE • P.V.C. • NYLON • P.T.F.E.**



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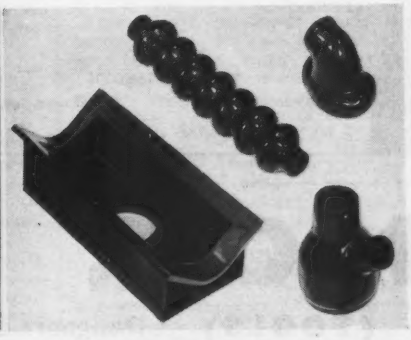

3. P.V.C. dippings and slush castings for highly flexible and oil-resistant mouldings at low tool and item cost.

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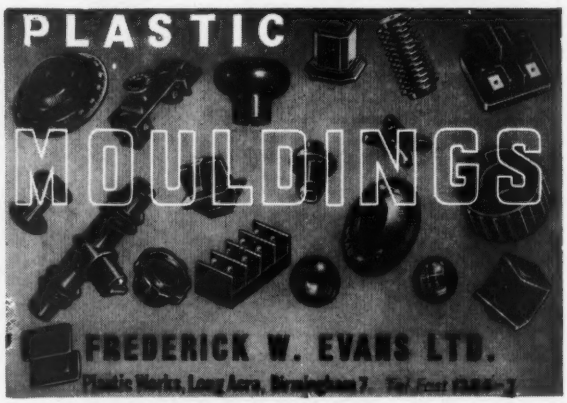


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FOR THE
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**SEBASTIAN STREET, LONDON, E.C.1**
CLE 1712/3

# Classified Advertisements

**PRESS DAY.—Classified advertisements for the February issue must be received at Head Office by first post Tuesday, January 24.**
**Last-minute additions and deletions are accepted by telephone from trade advertisers up to noon. Advertisements received too late for a particular issue are automatically inserted in the succeeding one unless instructions to the contrary are received.**

**RATES.**—4d. per word (minimum 12 words 4/-). Each paragraph charged separately and name and address must be paid for. Semi-displayed setting 35/- per single column inch. Series discounts of 5% for 6, and 10% for 12 consecutive insertions allowed to trade advertisers.

**TERMS.**—Strictly net and prepayable. Monthly accounts for settlement by the end of the month following insertion are allowed to trade advertisers if satisfactory references are provided.

**REMITTANCES.**—Cheques and postal orders should be crossed and made payable to TEMPLE PRESS LIMITED and instructions sent addressed to the Manager, "Plastics," Bowling Green Lane, London, E.C.1.

**THE PROPRIETORS** retain the right to refuse or withdraw advertisements at their discretion and are not responsible for clerical or printers' errors although every care is taken to avoid mistakes.

**BOX NUMBERS.**—Private advertisers desiring to have replies sent care of "Plastics" may do so on payment of 1/- to cover booking and postage, plus cost of four extra words. To avoid mistakes in forwarding, Box numbers should be carefully and legibly copied and replies sent to Box P000, care of "Plastics," Bowling Green Lane, London, E.C.1.

**DEPOSIT SYSTEM.**—Facilities are available to readers to purchase advertised goods on approval by depositing the purchase price with "Plastics." Full details on application. Commission 1% (minimum 2/-) on amount deposited.

**HEAD OFFICES:** Bowling Green Lane, London, E.C.1, England. Telephone: Terminus 3636. Telegrams: "Pressimus, Phone, London."

**BRANCH OFFICES:** 7, John Bright Street, Birmingham, 1. Telephone: Midland 4117-8. 50, Hertford Street, Coventry. Telephone: Coventry 62464. 1, Brazennose Street, Manchester. Telephone: Deansgate 6114-8. 12, Renfield Street, Glasgow. Telephone: Glasgow Central 1413.

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12 YORK STREET,
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Grams, Russonken, Manchester. zzz-304

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**SPEKE TRADING ESTATE, LIVERPOOL.** Modern 1-storey factory premises, specially equipped for woodworking, also suitable for veneering operations and low-pressure lamination. About 30,000 sq. ft. with extra land for development, heating, sprinkler installation, dust extractor plant, drying kiln, etc., some machinery available if required. Apply W. F. Bevan and Co., 7 Union Court, Cook St., Liverpool, 2. (Central 7381-5.) 222-7

## BUSINESS OPPORTUNITIES

**PROGRESSIVE COMPANY** marketing plastic goods in the United Kingdom with excellent established distribution, offers service to manufacturers as sole distributors. All offers to Aero Marketing, Ltd., 9 Warwick Court, W.C.1. 223-1157

**VACUUM FORMING CAPACITY AVAILABLE,** together with full facilities for fabricating, engraving and printing of all plastic materials. Omega Plastics, Ltd., Highbridge Rd., Town Quay, Barking, Essex. 223-1158

**WE OPERATE** the most efficient and extensive distribution service for plastic products in Great Britain, with or without manufacturing facilities. Designers with ideas for exploitation and moulders, etc., having products, particularly those of interest to the hardware trade, requiring nation-wide distribution, should write in confidence to the Managing Director, Box P1327, care of "Plastics." 222-12

**EXPERIENCED REPRESENTATIVE,** resident London, of good standing and well connected large users of compression, injection and reinforced mouldings offers sound permanent technical representative S.E. England to well-equipped trade moulder. Excellent references. Box P225, care of "Plastics." 222-19

## CONSULTANTS

**W. BRUCE BROWN, M.S.I.A.,** designer of many DEX housewares, is now in private practice, and would welcome enquiries for exclusive designs. 140 Roding Rd., Loughton, Essex. 222-x1975

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**STEEL PORTAL FRAME BUILDINGS.** For immediate delivery from stock.

30-ft. and 40-ft. single span or multiple spans, in heights of 9 ft., 12 ft., 15 ft. and 18 ft. to eaves; 50-ft. and 60-ft. spans for delivery in four weeks. Fully conforming with B.S.S. 449 and Code of Practice, framework only or complete buildings.

S. I. Buildings, Ltd., 238-240 Abbey House, Victoria St., London, S.W.1. Phone, Abbey 3964, and Ruskin Chambers, 191 Corporation St., Birmingham. 222-8

## MACHINERY, TOOLS AND PLANT

**FOR SALE,** Brookman motorized upright toggle single-action power-press with control box and ejector, suitable for bakelite and plastic moulding, approx. 8 tons exerted pressure. North Hill Plastics, Ltd., Manley Court, Stoke Newington, London, N.16. 222-3

PLASTICS MACHINERY
Hydraulic Presses of all sizes. Injection Machines. Extruders. Mixing Mills. Hydraulic Pumps and Accumulators.
Send your requirements to the specialists.
REED BROTHERS (ENGINEERING), LTD.,
REPLANT WORKS,
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Phone, East 4081 (five lines). 222-15

**400-TON UPSTROKE HYDRAULIC** by Rose, Downs and Thompson, ram 16-in. dia. by 14-in. stroke, with electric platens, 27 in. by 17 in.

Towler electraulic pump complete with oil tank and built-in 15 h.p. motor, capable of running above press with additional capacity.

100-140-ton downstroke hydraulic by Daniels, ram 12-in. dia. by 16-in. stroke, fitted timer unit and ejector gear, with 20-in. by 20-in. electric platens complete with built-in Towler pump and motor.

100-ton downstroke hydraulic by Bradley and Turton, ram 12-in. dia. by 11-in. stroke, with electric platens 20 in. by 20 in.

Two 100-ton upstroke hydraulics by Fowler and McCollin, ram 12-in. dia. by 10-in. stroke, with electric platens 19 in. by 13 in.

Bradley and Turton 4-throw pump with built-in 4 h.p. motor, capable of running three 100-ton presses.

50-ton upstroke hydraulic by Bradley and Turton, ram 8-in. dia. by 10-in. stroke with electric platens 15 in. by 15 in.

10-12-ton and 15-20-ton hand toggle presses with slotted tables.

Daniels pre-former No. 3 capacity up to 2¾ in. by 1¼ in. pellet, complete with built-in 10 h.p. motor.

Manesty (F type) tablet machine, capacity up to ¾-in. dia. pellet, complete with motor.

Radyne pre-heater, capacity up to 2-3 lb., 12 oz. per minute.

Compression moulding tools, bench drills, grinders, linishers, saws and miscellaneous machinery, P.V.C. and plastic sheeting.

Further particulars and prices from: Northern Plastics, Ltd., Chiswick Grove, Blackpool. Phone, Marton 940. 222-x2007

**Machinery, Tools and Plant (contd.)**

**HYDRAULIC.** Frazer mono-radial pumps, new and second-hand in stock. Thompson and Son (Millwall), Ltd., Cuba St., London, E.14. East 1844. zzz-302

**THE CORRY PLATFORM TRUCK** is the lowest-priced truck available at the present time with a 1-ton load capacity. Fitted with roller bearing wheels and rubber tyres. Details from J. L. Allen and Co., Chedington, Beaminster, Dorset. zzz-x9893

**NEW HIGH-SPEED ELECTRIC BANDSAWS** for sale for cutting Polythene, P.V.C. rubber, Perspex, cork, leather, cloth, etc., stainless steel or wood table. Three sizes, 24 in., 30 in., 36 in., max. height of cut on 36-in. machines 19 in.; 400-440 3-phase supply. Illustration and prices from makers, F. J. Edwards, Ltd., 359 Euston Rd., London, N.W.1. Euston 4681. 222-1

**FRANCIS SHAW HAND INJECTION MOULDER** for sale for thermoplastic material, 220-230 volts, capacity one shot per min. ⅜ oz., three shots per min. ⅛ oz., dia. of injection ram ⅞ in., working surface of dia. plates 7 in. Photo. F. J. Edwards, Ltd., 359 Euston Rd., London, N.W.1. 222-9

## MACHINERY, TOOLS AND PLANT WANTED

**SECOND-HAND** vacuum-forming machine wanted, preferably twin-table model, moulding area nearest to 36 in. by 36 in. Write Box P2210, care of "Plastics." 222-16

**WANTED,** one approximately 3-in. P.V.C. extruder. Box P229, care of "Plastics." 222-17

**LESTER 4-OZ. MACHINES** wanted, British or American. Write with details and price required to Box P 185, LPE, 55 St. Martin's Lane, W.C.2. 222-4

**HYDRAULIC PUMPS** required, 100 g.p.m. at 1-ton pressure. Box P2223, care of "Plastics." 223-1192

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**EXTEND YOUR TRADE.**
Use a trade mark. Consult
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**COMPRESSION MOULDS FOR SALE.** Consist of household articles, fancy goods, smokers' sundries, toys and games, etc. Would make a very good range in particular for an overseas moulder. Write for full details. Box P186, care of "Plastics." 223-1161

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**WANTED,** injection moulds for fancy goods or toys, capacity up to 8 oz. Box P2211, care of "Plastics." 222-26

## PRODUCTION CAPACITY

**P.V.C. SLUSH MOULDING AND DIPPING.** D. R. Cheshire, Ltd., 43 Newington Causeway, S.E.1. Phone, Hop 1816. zzz-296

**Production Capacity (contd.)**

**SMALL FACTORY,** equipped with hand-injection machines, fly and power presses, etc., capacity available or suggestions for use invited. London area. Box P1811, care of " Plastics." zzz-301

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INJECTION MOULDINGS AND PLASTIC COVERING IN ACETATE ALKATHENE, P.V.C., POLYSTYRENE AND DIAKON.
Machined Parts in Brass, Steel and Plastics.
We solicit your inquiries.
F. A. KETCH AND SON, LTD.,
TRENT VALLEY WORKS,
LICHFIELD, STAFFS.
Phone 3591 and 3592. zzz-500

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**CAPACITY AVAILABLE** for manufacturing compression and injection moulds, together with jigs and general engineering to customers' own designs, or alternatively, designed by us Inquiries for same will receive prompt attention. Elloid Engineering Co., Ltd., Goodacre St., Mansfield, Notts. Phone, Mansfield 2614. zzz-299

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BRITAIN'S LEADING STOCKISTS AND DISTRIBUTORS.
SPECIALISTS IN
FABRICATION, INJECTION MOULDING AND ENGRAVING.
11 WHITWORTH STREET,
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Central 7081-2 and Central 1000. zzz-493

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**REPETITION** in Ebonite, Erinoid, etc. Capstan lathe work. Temple St., Rugby. Phone 4059. 223-1118

**DINES PRODUCTS,** Whitehall Lane, Grays, Essex, for injection mouldings. 223-1120

**CASTINGS,** negligible tool costs.
Phenolic resin castings (plated or coloured), maximum size 6 in. by 4 in. by 1 in.
Quick delivery, any quantity, inquiries invited.
Bashford Hill and Co., Ltd. Works behind 44 Gloucester Rd., Croydon. Phone, Tho 3428. 224-1174

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**KINGSTON PLASTICS, LTD.,** Unity Works, Union St., Kingston-on-Thames. Manufacturers of virgin and second-grade cellulose acetate moulding powders, matched to customer's own requirements for colour and flow. Customer's own waste also reprocessed to specified requirements. Sorting and grinding, incorporating magnetic separation of metallic particles of all thermoplastics undertaken. Phone, Kingston 8405. 225-1174

**POLYSTYRENE AND CELLULOSE ACETATE INJECTION MOULDINGS** up to 2 oz. Reliable service. Latest-type machines. Keen co-operation on new lines. W. H. Adamson Plastics, Ltd., 39 Hedley St., Maidstone. 225-1175

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**CHIPPING OF PLASTICS AND GRINDING,** screening, mixing and drying of all raw materials undertaken for the trade. Crack Pulverizing Mills, Ltd., Plantation House, London, E.C.3. Man 4405. zzz-0302

**Production Capacity (contd.)**

**INJECTION MOULDINGS** by I.O.G. Industries, Ltd., 41 Marshgate Lane, Stratford, E.15. Maryland 2804. 232-1182

**INJECTION MOULDING CAPACITY** available up to 32 oz.; also design and toolroom facilities for mould construction. Write Box P2212, care of " Plastics." 222-27

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THE LEADING CRAFTSMEN IN " PERSPEX."
PROTOTYPE AND REPETITION.
OFFICIAL I.C.I. STOCKISTS " PERSPEX " SHEET, TUBE, ROD.
STOCKISTS AND FABRICATORS OF " FORMICA."
149 LONDON ROAD, CROYDON, SURREY.
Phone, Croydon 8228 (two lines). zzz-307

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**INJECTION MOULDING CAPACITY** available on 2-oz. Hupfield machines; sub-contract work acceptable; competitive prices, excellent service. Box P2219, care of " Plastics." 222-35

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**PERSPEX,** Formica, Warerite, Traffolyte Eng., sheet. Specialists in cut sizes. Immediate delivery.
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**AVAILABLE** 20 tons black polythene granules. Reasonable offer accepted. Box P1935, care of " Plastics." 222-14

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RODS, TUBES AND SHEETS.
PERSPEX
SHEETS UP TO 1 IN. THICK.
CELLULOSE ACETATE
CATALIN RODS.
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**ACETATE SCRAP,** clear, either from sheeting or injection mouldings, in large quantities, required. Offers with samples invited. Box P222, care of " Plastics." 222-23

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The engagement of persons answering advertisements in respect of vacant situations must be made through a local office of the Ministry of Labour, or a scheduled employment agency, if the applicant is a man between the ages of 18 and 64 inclusive or a woman between the ages of 18 and 59 inclusive, unless he or she, or the employment, is excepted from the provisions of Notification of Vacancies Order, 1952.

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**Situations Vacant (contd.)**

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**APPLICATIONS ARE INVITED** for the position of Assistant Works Manager, North London area, approx. 200 employees, previous practical experience preferred in hard and soft rubber and in plastics; knowledge of lead acid accumulator industry an advantage; age 25-45; salary about £600 p.a. depending upon qualifications. Details of education, experience, etc., to Box M1274, Haddon's, Salisbury Square, London, E.C.4. 222-11

**FRANCIS SHAW AND CO., LTD.,** require the services of an engineer for the Sales Staff at their London office who must have had experience in the rubber and/or plastics industries; car provided. Apply in writing, to Box MRR, Terminal House, Grosvenor Gardens, London, S.W.1. 223-1187

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Also required:—

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**INJECTION MOULD DESIGNER** or mould-maker with drawing experience required for new factory in S.W. London district. Design to cover 1 to 8 oz. presses.

Applicants should state experience and salary required to Box P2213, care of " Plastics." 222-33

**A VACANCY HAS ARISEN** in the Plastics Laboratory of a research and development-minded, progressive company in the South London area. The work is both novel and interesting, and would satisfy the creative ability of anyone keen and energetic. Minimum qualification B.Sc. degree, with a leaning towards chemistry. Applicants should be of British nationality, not more than 27 years of age, and have completed their Military Service. Wages according to qualifications and experience. Write to Box P228, care of " Plastics." 223-18

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**TOOLROOM SUPERINTENDENT** with design and estimating experience, all types of moulds, seeks progressive position. Box P2214, care of " Plastics." 222-32

**EXPERIENCED REPRESENTATIVE,** resident London, of good standing and well connected large users of compression, injection and reinforced mouldings, offers sound permanent technical representation S.E. England to well equipped trade moulder; excellent references. Box P226, care of " Plastics." 222-20

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**THE THEORY OF POLYMERIZATION,** by H. R. Fleck, M.Sc., F.R.I.C. Full examination in simple language with examples, calculations and exercises of this fundamental aspect of the chemistry of plastics. Illustrated, 144 pages, 10s. 6d. net from booksellers, or 11s. by post from the publishers, Temple Press Ltd., Bowling Green Lane, London, E.C.1. zzz

**PLASTICS, SCIENTIFIC AND TECHNOLOGICAL** (3rd edition), by H. R. Fleck, M.Sc., F.R.I.C. A completely revised edition of a recognized standard work on the chemistry and technology of plastics. ". . . should be in every technical library."—Times Review of Industry. Illustrated, 400 pages, 40s. net from booksellers, or 40s. 9d. by post from the publishers, Temple Press Ltd., Bowling Green Lane, London, E.C.1. zzz

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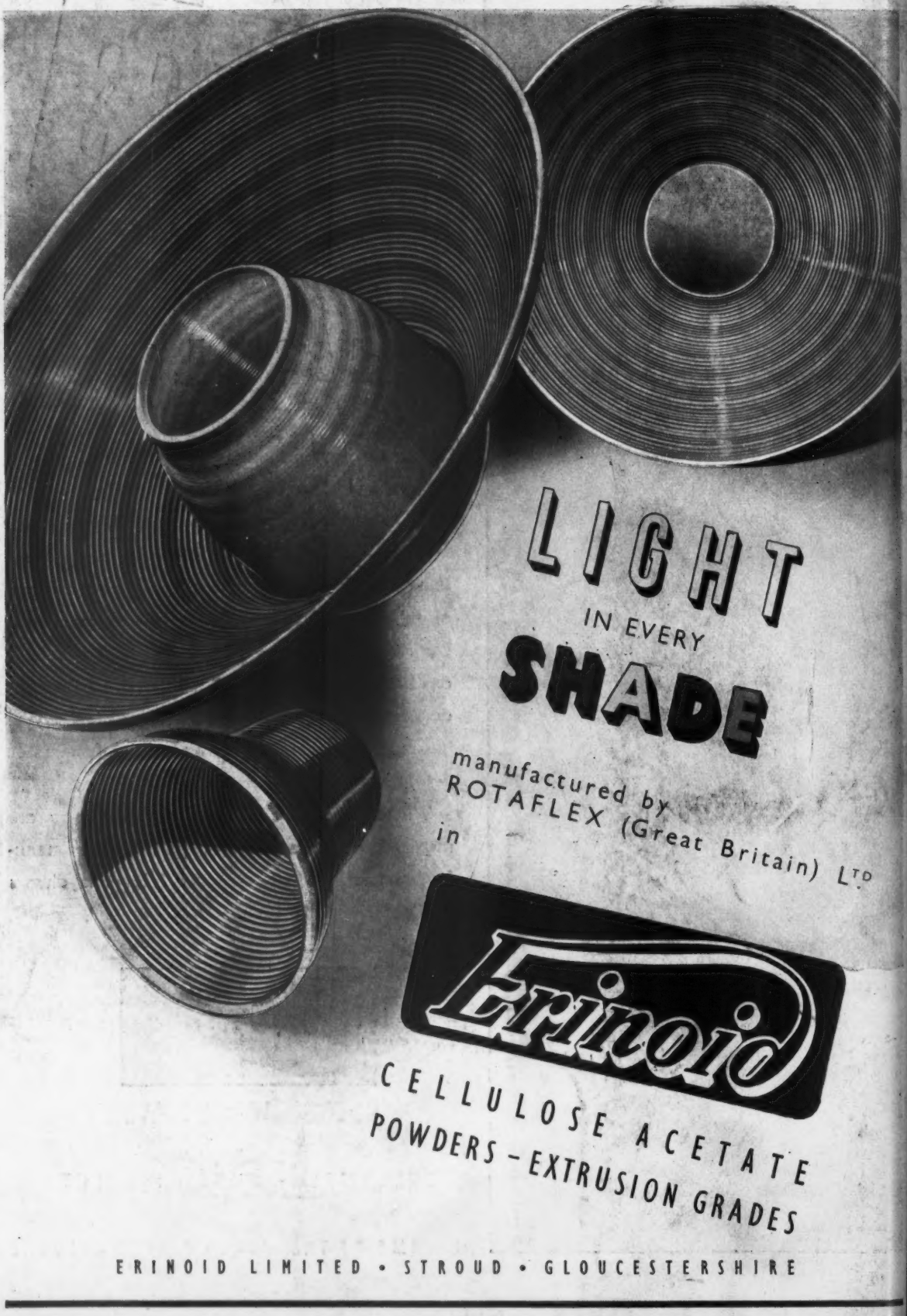
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